DRAFT ENVIRONMENTAL IMPACT ASSESSMENT
&
ENVIRONMENT MANAGEMENT PLAN

FOR OBTAINING

Environmental Clearance under EIA Notification – 2006

Schedule Sl. No. 1 (a) (i): Mining Project

"B1" CATEGORY – MINOR MINERAL – CLUSTER – NON-FOREST LAND

Total Cluster Extent= 8.80.0 Ha

TVL. NAVAMANI MINES PRIVATE LIMITED
ROUGH STONE AND GRAVEL QUARRY

At

S.F.No	:	15/1 & 15/2
Extent	:	2.80.5 Ha
Village	:	Sivayam (North)
Taluk	:	Krishnarayapuram
District	:	Karur

ToR obtained vide
Lr.No.SEIAA-TN.F.No.6993/SEAC/TOR-761/2020 Dated 24.09.2020

Project Proponent
Tvl. Navamani Mines Private Limited
Thiru. Palaniyandi Vimalathithan,
Director, No.5/898, Alagu Nagar,
Trichy Main Road,
Namakkal District – 637 001

EIA CONSULTANT

GEO EXPLORATION AND MINING SOLUTIONS

**Old No. 260-B, New No. 17,
Advaitha Ashram Road, Alagapuram,
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**Accredited for sector 1 'A',31 & 38 Category 'B'
Certificate No : NABET/EIA/2225/RA 0276**
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APRIL 2023

For the easy representation the proposed quarries and existing quarries are designated as below –

CLUSTER QUARRIES				
PROPOSED QUARRY				
CODE	**Name of the Owner**	**S.F.Nos & Village**	**Extent (ha)**	**Remarks**
P1	**Tvl. Navamani Mines Private Limited** Thiru. Palaniyandi Vimalathithan, Director, No.5/898, Alagu Nagar, Trichy Main Road, Namakkal District – 637 001	15/1 & 15/2 Sivayam (North) Village	2.80.5 ha	ToR obtained vide Lr.No. SEIAA-TN.F.No.6993/SEA C/TOR-761/2020 Dated 24.09.2020
TOTAL			**2.80.5 ha**	
EXISTING QUARRIES				
CODE	**Name of the Owner**	**S.F.Nos & Village**	**Extent (ha)**	**Lease period**
E1	**Thiru. A.Shanmugaraj** S/o. Appavu, No 219, Manapparai Main Road, Iyyar Malai, Sivayam Post, Karur District	13/1, 14/2 and 14/3 Sivayam (North) Village	2.49.5 ha	07.02.2018 to 06.02.2023
E2	**Thiru. D. Rathinam** S/o. Duraisamy, 153/A, Kampan Street, Kavery Nagar, Kulithalai Taluk, Karur District	30/1A, 30/1B Sivayam (North) Village	2.46.0 ha	07.02.2018 to 06.02.2023
E3	**Tmt. M.Jayamani,** W/o. Manoharan Ponniyagoundanpudhur, Punnamchathiram, Aravakurichi Taluk, Karur District	30/4, 31/1 Sivayam (North) Village	1.04.0 ha	06.12.2018 to 05.12.2023
E4	**Thiru. M.Palaniyandi**, S/o, Mottiyandi, 2/34, Ambalakkara street, Somarasampettai, Srisangam Taluk, Trichy District.	2/2 Sivayam (North) Village	2.34.5 ha	10.07.2014 to 09.07.2019
Total Extent			**5.99.50**	
Total Cluster Extent			**8.80.0**	

Source: Assistant Director Letter, (1) Rc.No. 256/Mines/2019, Dated 25.06.2019,

Total Extent of the Existing and proposed quarries in this cluster area is 8.80.0 Ha as per MoEF & CC Notification S.O. 2269 (E) Dated: 01.07.2016). The proposed project falls under Cluster - "B1" Category

TERMS OF REFERENCE (ToR) COMPLIANCE

Tvl. Navamani Mines Private Limited

"ToR issued vide Letter No. SEIAA-TN/F.No.6993/SEAC/ToR-761/2020 Dated 24.09.2020"

	SPECIFIC CONDITIONS	
1	The proponent shall furnish the contour map of the water table detailing the number of wells located around the site and impacts on the wells due to mining activity.	The contour map of the study area delineating water level is enclosed Figure No 3.7.
2	The proponent shall conduct the hydro – geological study to evaluate the impact of proposed mining activity on the ground water table, agriculture activity, and water bodies such as rivers, tanks canals, ponds etc., located nearby the proposed mining area.	Hydrogeological studies of the area is described in the chapter No 2
3	The proponent shall furnish the detail on number of ground water pumping wells, open wells within the radius of 1km along with the water levels in both monsoon and Non-monsoon seasons. The proponent would also collect the data of water table level in this area during both monsoon and non – monsoon seasons from the PWD/TWAD	There are about 31 Nos of open well within 1km radius from the project area (Core zone) depth of the water level in monsoon and non-monsoon is tabulated in the Chapter No 3, Table No 3.8B
4	The proponent shall conduct the cumulative impact study on the Agriculture area due to Mining, Crushers and other activities around the site area	The details of agriculture activity and livelihood of the people in the study area are studied and discussed under chapter No.3.
5	The details of surrounding well and the cumulative impact on the ground water shall be part of EIA study	Detailed in the Chapter No 3, Table No 3.8B
6	The socio economic impact assessment due to the project needs to be carried out within 10km of the buffer zone from the mines.	Socio-Economic Studies were carried out covering 10 km radius from the periphery of the project area and identified 26 villages. The details are discussed in Chapter No. 3, Page No. 78.
7	A detailed report on the green belt development already undertaken is to be furnished. They also need to submit the proposal for green belt activities for the proposed mines(s).	It is proposed to plant about 1680 Nos of trees during the Mining plan period for the proposed projects. The detailed Greenbelt Development Plan is discussed in Chapter No. 4, Page No. 90
8	Proposal for CER activities should be furnished taking into consideration the requirement of the local habitants available within the buffer zone as per Office memorandum of MoEF & CC Dated 01.05.2018.	Rs 5,00,000 allotted For CER activities detailed in Chapter No 4.9.
9	A detailed Mine- Closure plan for the proposed project shall be furnished.	Detailed Mine closure plan give in the chapter No 4.9, Page No 94
10	A detailed report on the safety and health aspects of the workers and for the surrounding habitants during operation of mining for drilling and blasting shall be submitted	Standard Operating Procedures as per DGMS for Safety and Health aspects of the workers and for surrounding habitants during mining operations is to be followed. The details are discussed under Chapter No. 10.
11	The recommendation for the issue of Terms of Reference is subject to the final outcome of the Hon'ble NGT, Principal bench, New Delhi in O.A.No.186 of 2016 (M.A.No. 350/2016) and O.A.No.200/2016 and O.A.No.580/2016(M.A.No.1182/2016) And O.A. No. 404/2016 (M.A.No758/2016, M.A.No 920/2016, M.A.No. 1122/2016, M.A.No.12/2017 & M.A.No. 843/2017) and O.A.No 405/2016 and O.A.No 520 of 2016 (M.A.No. 981/2016, M.A.No.982/2016 & M.A.No. 384/2017)	Agreed & Noted.

12	Details of the lithology of the mining lease area shall be furnished	Geology of the area and lithology is described in the chapter No 2.
13	A study shall be conducted on the number of trees (Name of the species, age) present in the mining lease applied area and how, it will be managed during mining activity.	No trees within the project area, thorny bushes and karuvelam trees are found within the project area.
14	The proponent shall furnish the following details along with the EIA report from AD/DD mines of concern District to ensure no violation file is appraised under the normal cases a) What was the period of the operation and stoppage of the earlier mines with last work permit issued by the AD/ DD Mines? b) Quantity of minerals mined out c) Detail of approved depth of mining d) Actual depth of the mining achieved earlier e) Name of the person already mined in the lease area f) If EC and CTO already obtained compliance report from competent authority to be furnished	Details of the existing quarry lease is given in the chapter No 2.1.

	ADDITIONAL CONDITIONS	
1	Details of study on social impact, including livelihood of local people	Detailed in Chapter No 3.
2	A specific study should include impact on flora & fauna, disturbance to migratory pattern of animals	Impact on the flora and fauna described in the Chapter No 4.
3	Reserve funds should be earmarked for proper closure plan	Detailed in Chapter No 4.
4	A detailed plan on plastic waste management shall be furnished. Further, the proponent should strictly comply with, Tamil Nadu Government Order (Ms) No. 84 Environment and Forest (EC.2) Department Dated 25.06.2018 regarding ban on one time use and throw away plastics irrespective of thickness with effect from 01.01.2019 under Environment (Protection) Act, 1986. In this connection, the project proponent has to furnish the action plan	The details of the plastic waste management along with Action plan is described in the Chapter No 4.8.1.
5	A detailed post – COVID health management plan for workers as per the ICMR and MHA guidelines or the state Govt. guidelines may be followed and report shall be furnished.	Health Management plan for the workers in post COVID – is detailed in Chapter No 4.7.5.

	STANDARD TERMS OF REFERENCE	
1.	Year-wise production details since 1994 should be given, clearly stating the highest production achieved in any one year prior to 1994. It may also be categorically informed whether there had been any increase in production after the EIA Notification 1994 came into force, w.r.t. the highest production achieved prior to 1994.	Not applicable. This is Not a violation category project. This proposal falls under B1 Category (Cluster).
2.	A copy of the document in support of the fact that the Proponent is the rightful lessee of the mine should be given.	The applied land for quarrying is patta land owned by Project Proponent. Patta copy, other land documents are enclosed as Annexure – IC.
3.	All documents including approved mine plan, EIA and Public Hearing should be compatible with one another in terms of the mine lease area, production levels, waste generation and its management, mining technology etc. and should be in the name of the lessee.	Noted & agreed.

4.	All corner coordinates of the mine lease area, superimposed on a High Resolution Imagery/ toposheet, topographic sheet, geomorphology and geology of the area should be provided. Such an Imagery of the proposed area should clearly show the land use and other ecological features of the study area (core and buffer zone).	Map showing – Project area is superimposed on Satellite imagery is enclosed in Figure No. 2.2. Project area boundary coordinates superimposed on Toposheet – Figure No. 2.3. Toposheet of the project area covering 10km radius – Figure No. 1.2. Geology map of the project area covering 10km radius - Figure No. 2.5.
5.	Information should be provided in Survey of India Toposheet in 1:50,000 scale indicating geological map of the area, geomorphology of land forms of the area, existing minerals and mining history of the area, important water bodies, streams and rivers and soil characteristics.	Geomorphological features are incorporated in the Toposheet map covering 10km radius around the project area Figure No. 2.9.
6.	Details about the land proposed for mining activities should be given with information as to whether mining conforms to the land use policy of the State; land diversion for mining should have approval from State land use board or the concerned authority.	The applied area was inspected by the officers of Department of Geology along with revenue officials and found that the land is fit for quarrying under the policy of State Government.
7.	It should be clearly stated whether the proponent Company has a well laid down Environment Policy approved by its Board of Directors? If so, it may be spelt out in the EIA Report with description of the prescribed operating process/procedures to bring into focus any infringement/deviation/ violation of the environmental or forest norms/conditions? The hierarchical system or administrative order of the Company to deal with the environmental issues and for ensuring compliance with the EC conditions may also be given. The system of reporting of non-compliances / violations of environmental norms to the Board of Directors of the Company and/or shareholders or stakeholders at large, may also be detailed in the EIA Report.	It is a fresh project for Environmental Clearance, The company framed Environmental Policy and the same has been approved by the Board of Directors. The details are given in the Chapter No 10.1.
8.	Issues relating to Mine Safety, including subsidence study in case of underground mining and slope study in case of open cast mining, blasting study etc., should be detailed. The proposed safeguard measures in each case should also be provided.	It is an opencast quarrying operation proposed to operate in Mechanized method. The rough stone formation is a hard, compact and homogeneous body. The height and width of the bench will be maintained as 5m with 90^0 bench angle.
9.	The study area will comprise of 10 km zone around the mine lease from lease periphery and the data contained in the EIA such as waste generation etc., should be for the life of the mine / lease period.	Noted & Agreed.
10.	Land use of the study area delineating forest area, agricultural land, grazing land, wildlife sanctuary, national park, migratory routes of fauna, water bodies, human settlements and other ecological features should be indicated. Land use plan of the mine lease area should be prepared to encompass preoperational, operational and post operational phases and submitted. Impact, if any, of change of land use should be given.	Land use and land cover of the study area is discussed in Chapter No. 3. Land use plan of the project area showing pre-operational, operational and post-operational phases are discussed in Chapter No. 2, Table No 2.3. There is no Wildlife Sanctuary, National Park, Biosphere Reserves, Reserve Forest/Protected Forest and Migratory Routes for fauna exists within 10 km radius of mining lease area.

11.	Details of the land for any Over Burden Dumps outside the mine lease, such as extent of land area, distance from mine lease, its land use, R&R issues, if any, should be given	Not Applicable. There is no waste anticipated during this quarry operation. The entire quarried out Rough stone and Gravel will be transported to the needy customers.
12.	A Certificate from the Competent Authority in the State Forest Department should be provided, confirming the involvement of forest land, if any, in the project area. In the event of any contrary claim by the Project Proponent regarding the status of forests, the site may be inspected by the State Forest Department along with the Regional Office of the Ministry to ascertain the status of forests, based on which, the Certificate in this regard as mentioned above be issued. In all such cases, it would be desirable for representative of the State Forest Department to assist the Expert Appraisal Committees.	Not Applicable There is no Forest Land involved in the proposed project site The proposed project area is proponent own patta land. The Patta copy is enclosed in Approved Mining Plan as Annexure – IC along with Mining plan
13.	Status of forestry clearance for the broken up area and virgin forestland involved in the Project including deposition of net present value (NPV) and compensatory afforestation (CA) should be indicated. A copy of the forestry clearance should also be furnished.	Not Applicable. There is no forest land involved in the Mining lease Area. (Please refer Chapter 3).
14.	Implementation status of recognition of forest rights under the Scheduled Tribes and other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 should be indicated.	There is no forest area within the mining lease. So, scheduled tribes and other Traditional forest Dwellers (Recognition of Forest Rights) Act, 2006 is not applicable.
15.	The vegetation in the RF / PF areas in the study area, with necessary details, should be given.	There is no Reserved Forest/Protected Forest within 10 km radius of the lease area.
16.	A study shall be got done to ascertain the impact of the Mining Project on wildlife of the study area and details furnished. Impact of the project on the wildlife in the surrounding and any other protected area and accordingly, detailed mitigative measures required, should be worked out with cost implications and submitted.	There is no Wildlife Sanctuary, National Park, Biosphere Reserves, Reserve Forest/Protected Forest and Migratory Routes for fauna exists within 10 km radius of mining lease area. Biological Study has been conducted for the project. There will be a likelihood increase in dust and noise levels, which will be controlled by water spraying and/or development of thick green belt around the mine boundary. Air quality & noise level will be maintained well within the standards prescribed by MoEF&CC and CPCB.
17.	Location of National Parks, Sanctuaries, Biosphere Reserves, Wildlife Corridors, Ramsar site Tiger/ Elephant Reserves/(existing as well as proposed), if any, within 10 KM of the mine lease should be clearly indicated, supported by a location map duly authenticated by Chief Wildlife Warden. Necessary clearance, as may be applicable to such projects due to proximity of the ecologically sensitive areas as mentioned above, should be obtained from the Standing Committee of National Board of Wildlife and copy furnished	There is no National Parks, Sanctuaries, Biosphere Reserves, Wildlife Corridors, Ramsar site Tiger/ Elephant Reserves and Migratory Routes for fauna exists within 10 km radius of mining lease area.
18.	A detailed biological study of the study area [core zone and buffer zone (10 KM radius of the periphery of the mine lease)] shall be carried out. Details of flora and fauna, endangered, endemic and RET Species duly authenticated, separately for core and buffer zone should be furnished based on such primary field survey, clearly indicating the Schedule of the fauna present. In case of any scheduled-I fauna found in the study area, the necessary plan along with budgetary provisions for their conservation should be	Biological Study for the study area (core zone & buffer zone) has been conducted within 10 km radius of the periphery of the mine lease. There is no endangered, endemic and RET Species in core and buffer area and there is no schedule-I fauna found in the study area as per Wildlife Protection Act 1972. (Please refer Chapter 3

	prepared in consultation with State Forest and Wildlife Department and details furnished. Necessary allocation of funds for implementing the same should be made as part of the project cost.	
19.	Proximity to Areas declared as 'Critically Polluted' or the Project areas likely to come under the 'Aravalli Range', (attracting court restrictions for mining operations), should also be indicated and where so required, clearance certifications from the prescribed Authorities, such as the SPCB or State Mining Department should be secured and furnished to the effect that the proposed mining activities could be considered.	No Critically Polluted areas as notified by the State Pollution Control Board The ML area does not fall under "Aravali range" as it is a project located in Karur district, Tamil Nadu.
20.	Similarly, for coastal Projects, A CRZ map duly authenticated by one of the authorized agencies demarcating LTL. HTL, CRZ area, location of the mine lease w.r.t CRZ, coastal features such as mangroves, if any, should be furnished. (Note: The Mining Projects falling under CRZ would also need to obtain approval of the concerned Coastal Zone Management Authority).	Not Applicable. The project area is 135km away from the coastal area hence the project doesn't attract The C. R. Z. Notification, 2018.
21.	R&R Plan/compensation details for the Project Affected People (PAP) should be furnished. While preparing the R&R Plan, the relevant State/National Rehabilitation & Resettlement Policy should be kept in view. In respect of SCs /STs and other weaker sections of the society in the study area, a need based sample survey, family-wise, should be undertaken to assess their requirements, and action programmes prepared and submitted accordingly, integrating the sectoral programmes of line departments of the State Government. It may be clearly brought out whether the village(s) located in the mine lease area will be shifted or not. The issues relating to shifting of village(s) including their R&R and socio-economic aspects should be discussed in the Report.	There are no Habitations Villages near the project site. No habitations within a radius of 300 meters The nearest House is 450m North West and Nearest Village is 850m from the West side of the project area. The project area core zone is dry barren land, No agriculture activities was carried out. Therefore, R&R Plan / Compensation details for the Project Affected People (PAP) is not anticipated and Not Applicable for this project.
22.	One season (non-monsoon) [i.e. March-May (Summer Season); October-December (post monsoon season) ; December-February (winter season)]primary baseline data on ambient air quality as per CPCB Notification of 2009, water quality, noise level, soil and flora and fauna shall be collected and the AAQ and other data so compiled presented date-wise in the EIA and EMP Report. Site-specific meteorological data should also be collected. The location of the monitoring stations should be such as to represent whole of the study area and justified keeping in view the pre-dominant downwind direction and location of sensitive receptors. There should be at least one monitoring station within 500 m of the mine lease in the pre-dominant downwind direction. The mineralogical composition of PM10, particularly for free silica, should be given.	Baseline Data were collected for One Season (pre monsoon) March to May 2021 The data's are collected as per the specification prescribed in the ToR and as per CPCB Notification and MoEF & CC Guidelines.
23.	Air quality modeling should be carried out for prediction of impact of the project on the air quality of the area. It should also take into account the impact of movement of vehicles for	Air Quality Modelling for prediction of incremental GLC's of pollutant was carried out using AERMOD view 9.6.1 Model. Details in Chapter No. 4, Page No. 82 - 86.

	transportation of mineral. The details of the model used and input parameters used for modeling should be provided. The air quality contours may be shown on a location map clearly indicating the location of the site, location of sensitive receptors, if any, and the habitation. The wind roses showing pre-dominant wind direction may also be indicated on the map.		
24.	The water requirement for the Project, its availability and source should be furnished. A detailed water balance should also be provided. Fresh water requirement for the Project should be indicated.	Total Water Requirement: 4.0 KLD, details of water requirement and its sources are described in the Chapter 2, Table No 2.12.	
25.	Necessary clearance from the Competent Authority for drawl of requisite quantity of water for the Project should be provided.	Water for dust suppression, greenbelt development and domestic use will be sourced from accumulated rainwater/seepage water in mine pits. Drinking water will be sourced from the approved water vendors, Refer Chapter 2, Table No 2.12	
26.	Description of water conservation measures proposed to be adopted in the Project should be given. Details of rainwater harvesting proposed in the Project, if any, should be provided.	The rain water collected in the pits after spell of rain will be used for greenbelt development and dust suppression.	
27.	Impact of the Project on the water quality, both surface and groundwater, should be assessed and necessary safeguard measures, if any required, should be provided.	Impact Studies and Mitigation Measures of Water Quality discussed in Chapter 4.	
28.	Based on actual monitored data, it may clearly be shown whether working will intersect groundwater. Necessary data and documentation in this regard may be provided. In case the working will intersect groundwater table, a detailed Hydro Geological Study should be undertaken and Report furnished. The Report inter-alia, shall include details of the aquifers present and impact of mining activities on these aquifers. Necessary permission from Central Ground Water Authority for working below ground water and for pumping of ground water should also be obtained and copy furnished.	The ground water table inferred 55m below ground level. The ultimate depth of quarry is 38m below the ground level the proposed depth will not intersect the ground water table, Chapter No 4.	
29.	Details of any stream, seasonal or otherwise, passing through the lease area and modification / diversion proposed, if any, and the impact of the same on the hydrology should be brought out.	There is no stream, seasonal or other water bodies passing within the project area. Therefore no modification/ diversion of water bodies are anticipated.	
30.	Information on site elevation, working depth, groundwater table etc. Should be provided both in AMSL and Bgl. A schematic diagram may also be provided for the same.	Highest elevation of the project area is 124m AMSL. Ultimate depth of the mine is 38m BGL. Water level of the area is 50-55m BGL	
31.	A time bound Progressive Greenbelt Development Plan shall be prepared in a tabular form (indicating the linear and quantitative coverage, plant species and time frame) and submitted, keeping in mind, the same will have to be executed up front on commencement of the Project. Phase-wise plan of plantation and compensatory afforestation should be charted clearly indicating the area to be covered under plantation and the species to be planted. The details of plantation already done should be given. The plant species selected for green belt should have greater ecological value and should be of good utility value to the local population	Time bound progressive greenbelt development plan prepared and discussed in the chapter No.4 Page No Table No 4.11. Recommended Species proposed for Greenbelt Development are given in the Chapter 10, Table No 10.8.	

	with emphasis on local and native species and the species which are tolerant to pollution.	
32.	Impact on local transport infrastructure due to the Project should be indicated. Projected increase in truck traffic as a result of the Project in the present road network (including those outside the Project area) should be worked out, indicating whether it is capable of handling the incremental load. Arrangement for improving the infrastructure, if contemplated (including action to be taken by other agencies such as State Government) should be covered. Project Proponent shall conduct Impact of Transportation study as per Indian Road Congress Guidelines.	Traffic density survey was carried out to analyse the impact of Transportation in the study area as per IRC guidelines 1961 and it is inferred that there is no significant impact due to the proposed transportation from the project area. Details in Chapter 2.6.3
33.	Details of the onsite shelter and facilities to be provided to the mine workers should be included in the EIA Report.	Infrastructure & other facilities will be provided to the Mine Workers after the grant of quarry lease and the same has been discussed in the Chapter No. 2 Page No. 33.
34.	Conceptual post mining land use and Reclamation and Restoration of mined out areas (with plans and with adequate number of sections) should be given in the EIA report.	The details of conceptual plan is discussed in Chapter No 2.6
35.	Occupational Health impacts of the Project should be anticipated and the proposed preventive measures spelt out in detail. Details of pre-placement medical examination and periodical medical examination schedules should be incorporated in the EMP. The project specific occupational health mitigation measures with required facilities proposed in the mining area may be detailed.	Details in Chapter 4
36.	Public health implications of the Project and related activities for the population in the impact zone should be systematically evaluated and the proposed remedial measures should be detailed along with budgetary allocations.	Details in Chapter 4
37.	Measures of socio economic significance and influence to the local community proposed to be provided by the Project Proponent should be indicated. As far as possible, quantitative dimensions may be given with time frames for implementation.	Details in Chapter 4, Page No. 91
38.	Detailed environmental management plan (EMP) to mitigate the environmental impacts which, should inter-alia include the impacts of change of land use, loss of agricultural and grazing land, if any, occupational health impacts besides other impacts specific to the proposed Project.	Environment Management Plan Chapter 10
39.	Public Hearing points raised and commitment of the Project Proponent on the same along with time bound Action Plan with budgetary provisions to implement the same should be provided and also incorporated in the final EIA/EMP Report of the Project.	The outcome of public hearing will be updated in the final EIA/EMP report
40.	Details of litigation pending against the project, if any, with direction /order passed by any Court of Law against the Project should be given.	No litigation is pending in any court against this project.
41.	The cost of the Project (capital cost and recurring cost) as well as the cost towards implementation of EMP should be clearly spelt out.	The project cost and EMP cost are detailed in Chapter 7

42.	A Disaster management Plan shall be prepared and included in the EIA/EMP Report.	Details in Chapter 7.3
43.	Benefits of the Project if the Project is implemented should be spelt out. The benefits of the Project shall clearly indicate environmental, social, economic, employment potential, etc.	Details in Chapter 8
44.	**Besides the above, the below mentioned general points are also to be followed:-**	
a)	Executive Summary of the EIA/EMP Report	Separately given in English and Tamil along with this Report
b)	All documents to be properly referenced with index and continuous page numbering.	All the documents are properly referenced with index and continuous page numbering.
c)	Where data are presented in the Report especially in Tables, the period in which the data were collected and the sources should be indicated.	List of Tables and source of the data collected are given properly.
d)	Project Proponent shall enclose all the analysis/testing reports of water, air, soil, noise etc. using the MoEF&CC/NABL accredited laboratories. All the original analysis/testing reports should be available during appraisal of the Project	Baseline monitoring reports are enclosed with This report in Chapter No – III. Original Baseline monitoring reports will be submitted in the final EIA report during appraisal.
e)	Where the documents provided are in a language other than English, an English translation should be provided.	Not Applicable.
f)	The Questionnaire for environmental appraisal of mining projects as devised earlier by the Ministry shall also be filled and submitted.	-
g)	While preparing the EIA report, the instructions for the Proponents and instructions for the Consultants issued by MoEF&CC vide O.M. No. J-11013/41/2006-IA.II(I) Dated: 4th August, 2009, which are available on the website of this Ministry, should be followed.	Instructions issued by MoEF & CC O.M. No. J-11013/41/2006-IA.II (I) Dated: 4th August, 2009 are followed.
h)	Changes, if any made in the basic scope and project parameters (as submitted in Form-I and the PFR for securing the TOR) should be brought to the attention of MoEF&CC with reasons for such changes and permission should be sought, as the TOR may also have to be altered. Post Public Hearing changes in structure and content of the draft EIA/EMP (other than modifications arising out of the P.H. process) will entail conducting the PH again with the revised documentation	There is no changes in the proposal in the basic scope and parameters submitted for the Terms of Reference.
i)	As per the circular no. J-11011/618/2010-IA.II(I) Dated: 30.5.2012, certified report of the status of compliance of the conditions stipulated in the environment clearance for the existing operations of the project, should be obtained from the Regional Office of Ministry of Environment, Forest and Climate Change, as may be applicable.	Not applicable.
j)	The EIA report should also include (i) surface plan of the area indicating contours of main topographic features, drainage and mining area, (ii) geological maps and sections and (iii) sections of the mine pit and external dumps, if any, clearly showing the land features of the adjoining area.	Surface Plan – Figure No. 2.3 Geological Plan – Figure No 2.8 Working Plan – Figure No 2.10

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1.   INTRODUCTION

1.0   PREAMBLE

Environmental Impact Assessment (EIA) is the management tool to ensure the sustainable development and it is a process, used to identify the environmental, social and economic impacts of a project prior to decision-making. It is a decision making tool, which guides the decision makers in taking appropriate decisions for any project. EIA systematically examines both beneficial and adverse consequences of the project and ensures that these impacts are taken into account during the project designing. It also reduces conflicts by promoting community participation, information, decision makers, and helps in developing the base for environmentally sound project.

Rough Stone and Gravel are the major requirements for construction industry. This EIA report is prepared for Tvl. Navamani Mines Private Limited applied for Rough stone and Gravel quarry lease in S.F.Nos 15/1 & 15/2 over an extent of 2.80.5 Ha in Sivayam (North) Village, Krishnarayapuram Taluk, Karur District.

Environment Impact Assessment taken by including Cumulative load of Existing and proposed quarries within the radius of 500m from the proposed project site. Four Existing Quarries and one proposed Quarry (This project) falls in the cluster area, total extent of Cluster is 8.80.0 ha. Cluster area calculated as per MoEF & CC Notification S.O. 2269(E) Dated 1st July 2016.

This EIA Report is prepared in compliance with ToR obtained vide letter No Lr.No.SEIAA-TN.F.No.6993/SEAC/TOR-761/2020 Dated 24.09.2020 for Tvl Navamani Mines and the Baseline Monitoring study has been carried out during the period of March to May 2021

1.1   PURPOSE OF THE REPORT

The Ministry of Environment and Forests, Govt. of India, through its EIA notification S.O. 1533(E) of 14th September 2006 and its subsequent amendments as per Gazette Notification S.O. 3977 (E) of 14thAugust 2018, Mining Projects are classified under two categories i.e., A (> 100 Ha) and B (≤ 100 Ha), and Schematic Presentation of Requirements on Environmental Clearance of Minor Minerals including cluster situation in Appendix – XI.

Now, as per Order Dated: 04.09.2018 & 13.09.2018 passed by Hon'ble National Green Tribunal, New Delhi in O.A. No. 173 of 2018 & O.A. No, 186 of 2016 and MoEF & CC Office Memorandum F. No. L-11011/175/2018-IA-II (M) Dated: 12.12.2018 clarified the requirement for EIA, EMP and therefore, Public Consultation for all areas from 5 to 25 ha falling in Category B - 1 and appraised by SEAC/ SEIAA as well as for cluster situation.

The proposed project is categorized under category "B1" Activity 1(a) (mining lease area in cluster situation) and will be considered at SEIAA – TN after conducting Public Hearing and Submission of Final EIA/EMP Report for Grant of Prior Environmental Clearance.

"Draft EIA report prepared on the basis of ToR Issued for the grant of Prior Environmental Clearance from SEIAA, Tamil Nadu"

FIGURE 1.1: SATELLITE IMAGERY CLUSTER QUARRIES

SATELLITE IMAGERY MAP- Tvl. NAVAMANI MINES PRIVATE LIMITED (500m Radius)

ID	Owners Name	Extent (ha)
	Proposed Quarry	
P-1	Tvl. Navamani Mines private Limited	2.80.5
	Existing Quarry	
E-1	Thiru.A. Shanmugaraj	2.49.5
E-2	Thiru.D. Rathinam	2.46.0
E-3	Tmt.M.Jayamani	1.70.5
E-4	Thiru.M. Palaniyandi	2.34.5

Legend
- Proposed Quarry
- Existing Quarry
- 300m_Radius
- 500m_Radius

Project Proponent	: Tvl. Navamani Mines Private Limited
Extent	: 2.80.5 ha
Village	: Sivayam (North)
Taluk	: Krishnarayapuram
District	: Karur
State	: Tamil Nadu

Graphic Scale

Software Used: Arc Map 10.8

Source: 1. Geographical Information System

Environment Consultant
M/S. Geo Exploration and Mining Solutions, Salem, Tamil Nadu

Drafted by	Checked by
Mr.A.Allimuthu (FAE - Land use & Land cover)	Dr. M. Ifthikhar Ahmed (EIA - Coordinator)

GEO EXPLORATION AND MINING SOLUTIONS

1.2   IDENTIFICATION OF PROJECT AND PROJECT PROPONENT

1.2.1   Identification of Project

The Project area is located in S.F.Nos 15/1 & 15/2, Sivayam (North) Village, Krishnarayapuram Taluk and Karur District.

- Proponent applied for Rough stone and Gravel quarry lease Dated 24.04.2019
- Precise area communication letter received for the preparation of Mining plan vide Rc.No 256/Kanimam/2019 Dated 19.06.2019
- Mining plan got approved by the Deputy Director, Geology and Mining, Karur vide Rc.No 256/Kanimam/2019 Dated 24.06.2019

1.2.2   Identification of Project Proponent

Name of the Project Proponent	:	**Thiru Palaiyandi Vimalathithan**
		Director
		Tvl. Navamani Mines Private Limited
Address	:	No. 5/898, Alagu Nagar
		Trichy Road,
District	:	Namakkal
State	:	Tamil Nadu
Pin code	:	637 001
Mobile No	:	+91 94433 44331
Email id.	:	navamanimines@gmail.com

Tvl Navamani Mines Private Limited is a Limited Company. Thiru Palaiyandi Vimalathithan is the Director nominated as Authorized signatory by the board of Directors in the company.

1.3   BRIEF DESCRIPTION OF THE PROJECT

1.3.1   Nature and Size of the Project

The quarrying operation is proposed to be carried out by Opencast Mechanized Mining method with 5.0m bench height and 5.0m bench width by deploying Hydraulic Excavator, Slurry Blasting and Tippers will be deployed for the transportation of minerals.

On the basis of available reserves the life of the mine is computed and approved as 20 Years.
Proposed production for the Mining Plan Period (5 years) is described below–

Estimated Production of Rough stone for 5 years	=	3,95,935 m^3
Production per day	=	264 m^3
No of Lorry loads per day	=	44 Lorry Loads of Rough stone
Estimated Production of Gravel for 3 years	=	49,332 m^3
Production per day	=	55 m^3
No of Lorry loads per day	=	9 Lorry Loads of Gravel

Totally 53 Lorry loads mineral will be dispatched from the project site.

TABLE 1.2: RESOURCES AND RESERVES

Description	Rough stone in m^3	Gravel formation in m^3
Geological Resources	9,80,455	84,039
Mineable Reserves	3,95,935	49,332
Year-wise Production (Mining Plan Period)	3,95,935	49,332

Source: Approved Mining Plan

TABLE 1.3: SALIENT FEATURES OF THE PROPOSED PROJECT

SALIENT FEATURES OF PROJECT	
Name of the Quarry	Tvl. Navamani Mines and Minerals Rough Stone and Gravel Quarry
Mining Plan Period / Lease Period	5 Years

	Pit	Length in m	Width in m	Depth in m
Existing Pit dimension	I	25	15	3
	II	37	18	3
Ultimate Pit dimension	I	208	103	38
Toposheet No	58 J/05			
Latitude between	10°52'19.57"N to 10°52'25.68"N			
Longitude between	78°22'26.70"E to 78°22'34.23"E			
Highest Elevation	124 m AMSL			
Geological Resources	Rough Stone in m³		Gravel m³	
	9,80,455		84,039	
Mineable Reserves	Rough Stone in m3		Gravel m3	
	3,95,935		49,332	
Water Level in the surrounds area	The Water table is found at a depth of 50m in summer and at 45m in rainy seasons.			
Method of Mining	Opencast Mechanized Mining Method involving drilling and blasting			
Machinery proposed	Jack Hammer		10 Nos	
	Compressor		2 Nos	
	Hydraulic Excavator		2 Nos	
	Tippers		5 Nos	
Blasting Method	Usage of Slurry Explosive with MSD detonators			
Proposed Manpower Deployment	36 Nos			
Project Cost	Project Cost		Rs 65, 68,505/-	
	EMP Cost		Rs 3, 80,000/-	
	Total		Rs 69, 48,505/-	
Cer Cost	Rs.5,00,000/-			

Source: Approved Mining Plan

1.3.2 Location of the Project

The Project area is fall in Sivayam (North) village, Krishnarayapuram Taluk and Karur District.

This cluster project is located – 2.0km South West of Iyermalai Village, 3.0 km North West of Irumboothipatti Village, these villages located in Kulithalai – Manapparai (SH - 71) Road. The District Headquarters Karur is located 32km North west.

FIGURE 1.2: KEY MAP SHOWING THE LOCATION OF THE PROJECT SITE
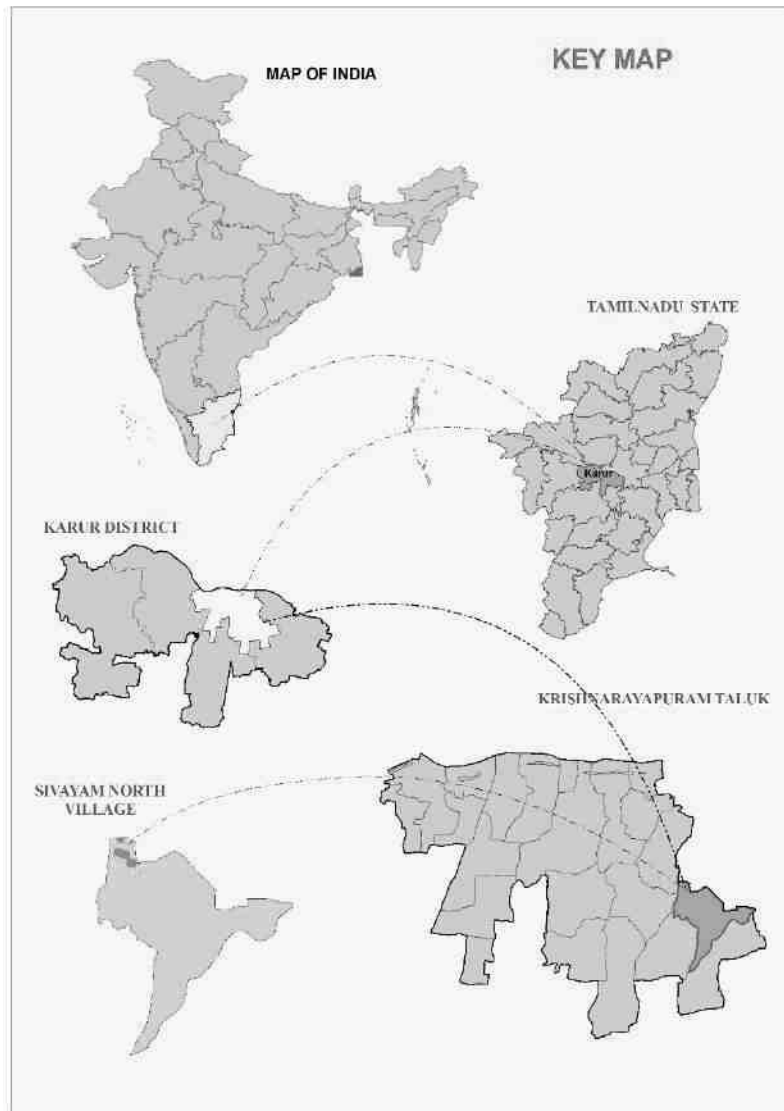
Source: Survey of India Toposheet 57-P/10

FIGURE 1.3: TOPOSHEET MAP OF THE STUDY AREA 10 KM RADIUS
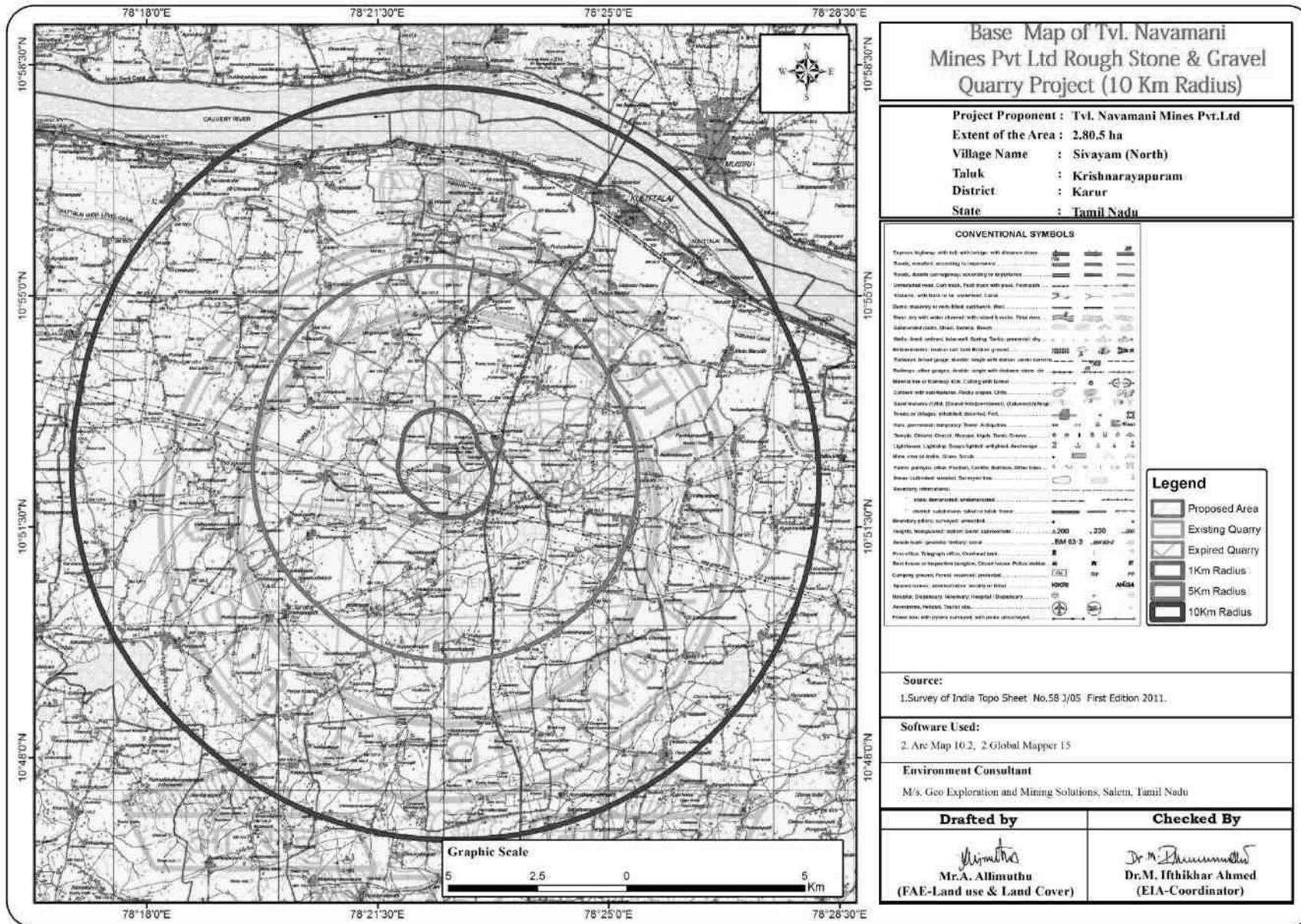
1.4   ENVIRONMENTAL CLEARANCE

The Proponent had applied for ToR for Environmental Clearance vide online Proposal No. SIA/TN/MIN/38701/2019 Dated: 05.07.2019

The Environmental Clearance process for the project will comprise of four stages. These stages in sequential order are given below:-

1. Screening,
2. Scoping
3. Public consultation &
4. Appraisal

SCREENING –
- The proponent applied for Rough Stone and Gravel Quarry Lease, Dated: 24.04.2019
- Precise Area Communication Letter was issued by the District Collector, Karur, vide Rc.No 256/Kanimam/2019 Dated 19.06.2019
- The Mining Plan was prepared and got approved by Assistant Director, Geology and Mining, Tiruvannamalai District, vide Rc.No 256/Kanimam/2019 Dated 24.06.2019
- Proponent applied for ToR to get Environmental Clearance vide online Proposal No. SIA/TN/MIN/38701/2019 Dated: 05.07.2019
- Proponent submitted application Hard copy for Terms of Reference Dated 01.08.2019

SCOPING –
- The proposal was placed in 166th SEAC meeting held on 30.07.2020 and the committee recommended for issue of ToR.
- The proposal was considered in 397th SEIAA meeting held on 21.09.2020 and issued ToR vide Letter No SEIAA-TN/F.No. 6993/SEAC/ToR-761/2020 Dated 24.09.2020

Public Consultation –

Application to The Member Secretary of the Tamil Nadu Pollution Control Board (TNPCB) to conduct Public Hearing in a systematic, time bound and transparent manner ensuring widest possible public participation at the project site or in its close proximity in the District is submitted along with this Draft EIA/ EMP Report and the outcome of public hearing proceedings will be detailed in the Final EIA/EMP Report.

Appraisal –

Appraisal is the detailed scrutiny by the State Expert Appraisal Committee (SEAC) of the application and other documents like the final EIA & EMP Report, outcome of the Public Consultations including Public Hearing Proceedings, submitted by the proponent to the regulatory authority concerned for grant of environmental clearance.

The report has been prepared using the following references:

- Guidance Manual of Environmental Impact Assessment for Mining of Minerals, Ministry of Environment and Forests, February, 2010
- EIA Notification, 14th September, 2006
- ToR Letter No. SEIAA-TN/F.No. 6993/SEAC/ToR-761/2020 Dated 24.09.2020
- Approved Mining Plan of this project
- In addition, other relevant standards for individual activities such as Sampling and Testing of Environmental attributes have been followed

1.5   POST ENVIRONMENT CLEARANCE MONITORING

The Project Proponent will submit a half-yearly compliance report in respect of stipulated Environmental Clearance terms and conditions to MoEF & CC Regional Office & SEIAA after grant of EC on 1st June and 1st December of every year.

1.6   GENERIC STRUCTURE OF EIA DOCUMENT

The overall contents of the EIA report follow the list of contents prescribed in the EIA Notification 2006 and the "Environmental Impact Assessment Guidance Manual for Mining of Minerals" published by MoEF & CC.

1.7   THE SCOPE OF THE STUDY

The main scope of the EIA study is to quantify the cumulative impact in the study area due to cluster quarries and formulate the effective mitigation measures for each individual leases. A detailed account of the emission sources, emissions control equipment, background Air quality levels, Meteorological measurements, Dispersion model and all other aspects of pollution like effluent discharge, Dust generation etc., have been discussed in this report. The baseline monitoring study has been carried out during the monsoon season Pre monsoon March to May 2021 for various environmental components so as to assess the anticipated impacts of the cluster quarry projects on the environment and suggest suitable mitigation measures for likely adverse impacts due to the proposed project.

TABLE 1.4: ENVIRONMENT ATTRIBUTES

Sl.No.	Attributes	Parameters	Source and Frequency
1	Ambient Air Quality	PM_{10}, $PM_{2.5}$, SO_2, NO_2	Continuous 24 hourly samples twice a week for three months at 8 locations (2 Core & 6 Buffer)
2	Meteorology	Wind speed and direction, temperature, relative humidity and rainfall	Near project site continuous for three months with hourly recording and from secondary sources of IMD station
3	Water quality	Physical, Chemical and Bacteriological parameters	Grab samples were collected at 4 ground water and 2 surface water locations once during study period.
4	Ecology	Existing terrestrial and aquatic flora and fauna within 10 km radius circle.	Limited primary survey and secondary data was collected from the Forest department.
5	Noise levels	Noise levels in dB(A)	8 locations – data monitored once for 24 hours during EIA study
6	Soil Characteristics	Physical and Chemical Parameters	Once at 4 locations during study period
7	Land use	Existing land use for different categories	Based on Survey of India topographical sheet and satellite imagery and primary survey.
8	Socio-Economic Aspects	Socio-economic and demographic characteristics, worker characteristics	Based on primary survey and secondary sources data like census of India 2011.
9	Hydrology	Drainage pattern of the area, nature of streams, aquifer characteristics, recharge and discharge areas	Based on data collected from secondary sources as well as hydro-geology study report prepared.
10	Risk assessment and Disaster Management Plan	Identify areas where disaster can occur by fires and explosions and release of toxic substances	Based on the findings of Risk analysis done for the risk associated with mining.

Source: Onsite Monitoring Data/Sampling by KGS Laboratories

The data has been collected as per the requirement of the ToR issued by SEIAA – TN and Standard ToR Published by MoEF & CC.

1.7.1   Regulatory Compliance & Applicable Laws/Regulations

- Application for Quarrying Lease as per Tamil Nadu Minor Mineral Concession Rules, 1959
- Obtained Precise Area Communication Letter as per Tamil Nadu Minor Mineral Concession Rules, 1959 for Preparation of Mining Plan and obtaining Environmental Clearance
- The Mining Plan of Rough Stone and Gravel quarry has been approved under Rule 41 & 42 as amended of Tamil Nadu Minor Mineral Concession Rules, 1959
- ToR from SEIAA

2.   PROJECT DESCRIPTION

2.0   GENERAL

The Rough Stone and Gravel Quarry Project require Prior Environmental Clearance for an extent of 2.80.5 ha. The total Extent of the quarries within the radius of 500m is > 5 ha; hence the project is falls under B1 Category as per the Order Dated: 04.09.2018 & 13.09.2018 passed by Hon'ble National Green Tribunal, New Delhi in O.A. No. 173 of 2018 & O.A. No, 186 of 2016 and MoEF & CC Office Memorandum F. No. L-11011/175/2018-IA-II (M) Dated: 12.12.2018, and requirement for EIA/EMP and Public Consultation.

The Environmental Impact Assessment report has been prepared in terms of EIA notification of the MoEF & CC dated 14.09.2006 and the EIA guideline manual for mining of minerals (Feb 2010) and ToR issued for the project vide Letter No. SEIAA-TN/F.No. 6993/SEAC/ToR-761/2020 Dated 24.09.2020

2.1   DESCRIPTION OF THE PROJECT

The proponent applied for Rough Stone and Gravel Quarry Lease vide application dated 24.04.2019 over an extent of 2.80.5ha. The precise area communication letter issued by the District Collector Dated 19.06.2019, the mining plan has been prepared and got approved by Deputy Director, Karur District Dated: 25.06.2019.

Previously the quarry lease was granted to Thiru. Narasimman vide Collector proceeding No 115/Kanimam/2005 Dated 23.08.2005 (14.09.2005 to 13.09.2010). During this lease period the lessee excavated two pits in the project area the details of the existing pit dimension is Pit I 25m (L) X 15m (W) X 3m (D), Pit II 37m (L) X 18m (W) X 3m (D)

The area is dry barren land, no major vegetation or trees within the project area, the project is site specific and there is no additional area required for this project. There is no effluent generation/discharge from the proposed quarry.

Rough Stone and Gravel is proposed to be excavated by opencast mechanized method involving splitting of rock mass of considerable volume from the parent rock mass by jackhammer drilling and blasting, hydraulic excavators are used for loading the Rough Stone from pithead to the needy crushers and rock breakers to avoid secondary blasting.

2.2   LOCATION OF THE PROJECTS

- The project area is located in Sivayam (North) Village, Krishnarayapuram Taluk & Karur District, and Tamil Nadu State.
- The project falls in Toposheet No: 58 J/05
- The cluster areas falls in the Latitude between 10°52'19.57"N to 10°52'25.68"N and Longitude between 78°22'26.70"E to 78°22'34.23"E
- The project area is patta land (Non-Forest Land) & There is no Eco – sensitive zone, Wild life Sanctuary, National Park, Tiger Reserve, Elephant Corridor and Biosphere Reserves within the radius of 10km from the project site.

TABLE 2.1: SITE CONNECTIVITY TO THE PROJECT AREA

Nearest Roadway	Cart Track – 150m – South (Connecting – Ayyarmalai – Kuzhanthai patti Village) Village Road – 400m North West (Kuzhanthai patti Village) (NH 67) Karur – Trichy – 9.0 km North (SH 71) Kulithalai – Manapparai - 1.3 km East side
Nearest Village	Kuzhanthai patti Village – 1.0 km- South West (Population – 1,360)
Nearest Town	Kulithalai – 9.0 km - NW
Nearest Railway Station & Railway Line	Kulithalai – 9.0 km - NE
Nearest Airport	Tiruchirapalli Airport – 37 km – South East
Seaport	Thoothukudi 235 km South side

Source: Survey of India Toposheet

The area is bounded by twenty seven coners/ pillars the co ordinates for all the pillars are given below –

TABLE 2.2: BOUNDARY CO-ORDINATES OF PROPOSED PROJECTS

Boundary Pillar No.	Latitude	Longitude
1	10°52' 20.98"N	78° 22' 26.74"E
2	10°52' 21.88"N	78° 22' 26.70"E
3	10°52' 25.68"N	78° 22' 26.97"E
4	10°52' 25.33"N	78° 22' 28.56"E
5	10°52' 24.24"N	78° 22' 28.62"E
6	10°52' 23.57"N	78° 22' 32.94"E
7	10°52' 23.63"N	78° 22' 34.23"E
8	10°52' 21.50"N	78° 22' 34.14"E
9	10°52' 19.57"N	78° 22' 33.91"E

Source: Approved Mining Plan

FIGURE 2.1: PHOTOGRAPHS OF THE PROJECT AREA

FIGURE 2.2: GOOGLE IMAGE SHOWING ROUGH STONE AND GRAVEL QUARRY PROJECT AREA
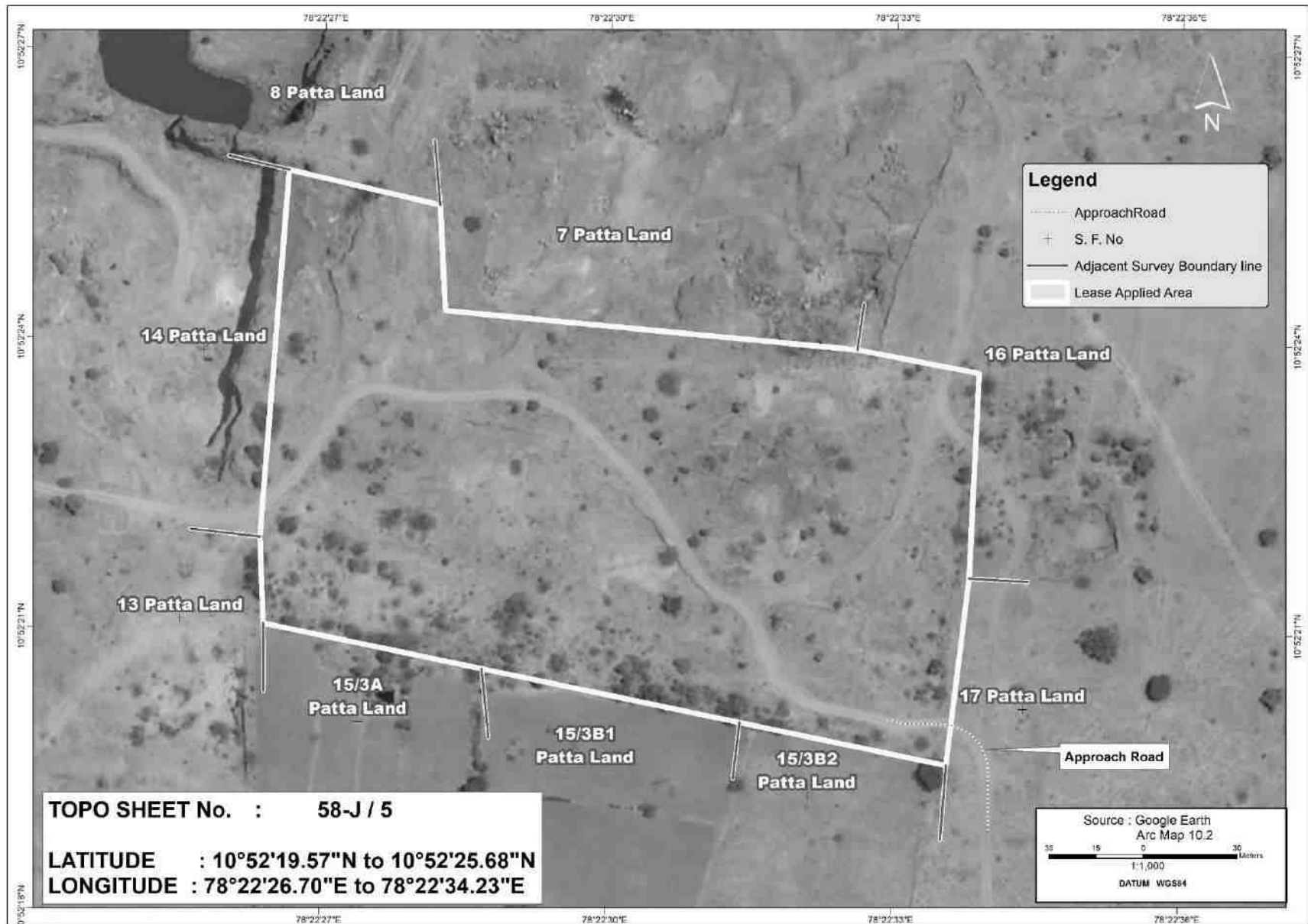
Source: Superimposed on Google Earth Imagery

FIGURE 2.3 : QUARRY LEASE PLAN & SURFACE PLAN
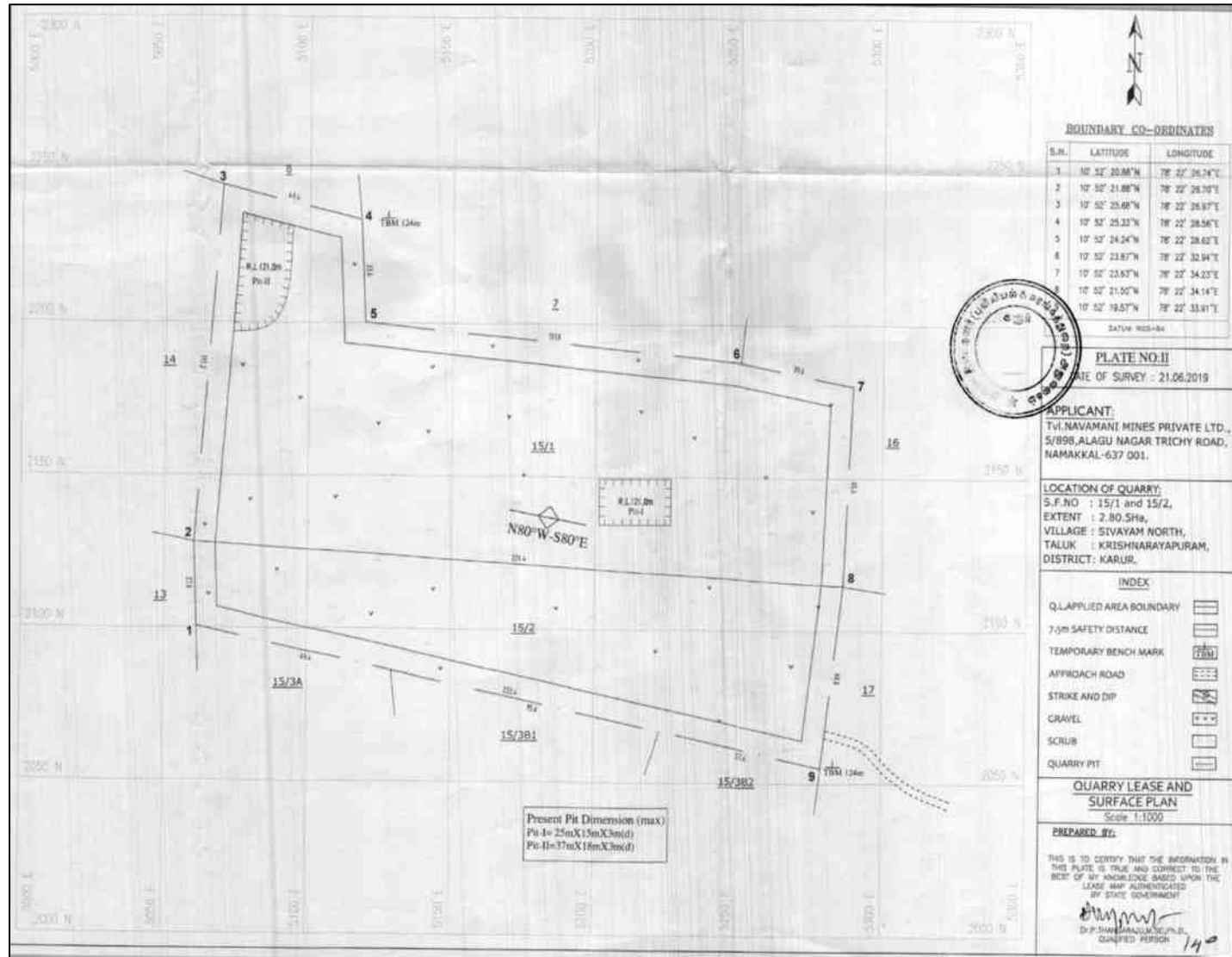
Source: Approved Mining Plan

FIGURE 2.4: VILLAGE MAP SUPERIMPOSED ON GOOGLE EARTH IMAGE

SUPERIMPOSED VILLAGE MAP- Tvl. NAVAMANI MINES PRIVATE LIMITED (500m Radius)

ID	Owners Name	Extent (ha)
Proposed Quarry		
P-1	Tvl. Navamani Mines private Limited	2.80.5
Existing Quarry		
E-1	Thiru.A. Shanmugaraj	2.49.5
E-2	Thiru.D. Rathinam	2.46.0
E-3	Tmt.M.Jayamani	1.70.5
E-4	Thiru.M. Palaniyandi	2.34.5

Legend
- Proposed Quarry
- Existing Quarry
- 300m_Radius
- 500m_Radius

Project Proponent : Tvl. Navamani Mines Private Limited	
Extent : 2.80.5 ha	
Village : Sivayam (North)	
Taluk : Krishnarayapuram	
District : Karur	
State : Tamil Nadu	

Graphic Scale

Software Used: Arc Map 10.8

Environment Consultant
M/S. Geo Exploration and Mining Solutions, Salem, Tamil Nadu

Source:
1. Geographical Information System

Drafted by	Checked by
Mr.A.Allimuthu (FAE - Land use & Land cover)	Dr. M. Ifthikhar Ahmed (EIA - Coordinator)

Source: Google Earth Pro & Village Map

FIGURE 2.5: IMAGE SHOWING SURFACE FEATURES AROUND 10 KM RADIUS
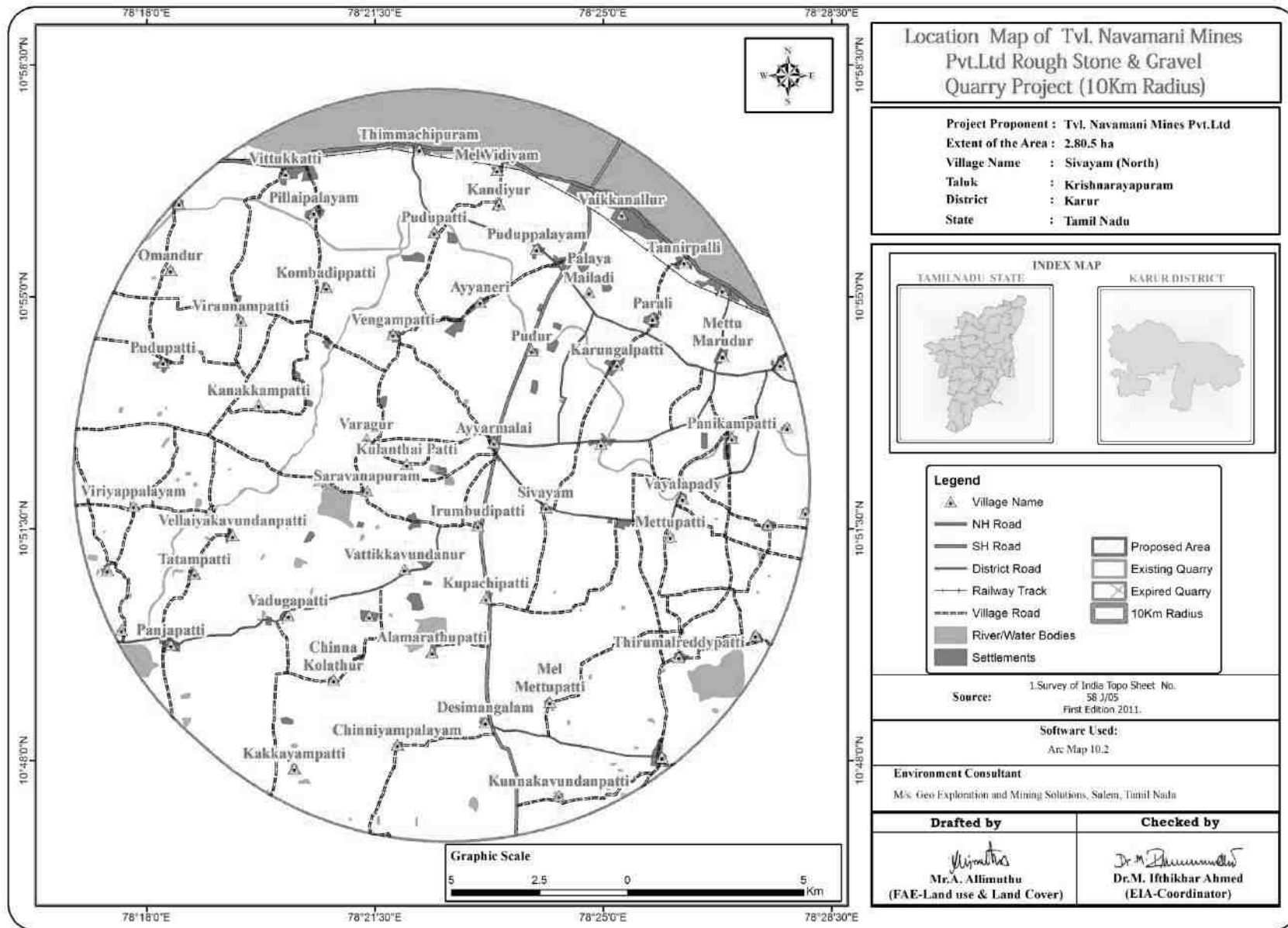
FIGURE 2.6: IMAGE SHOWING SURFACE FEATURES AROUND 5KM RADIUS
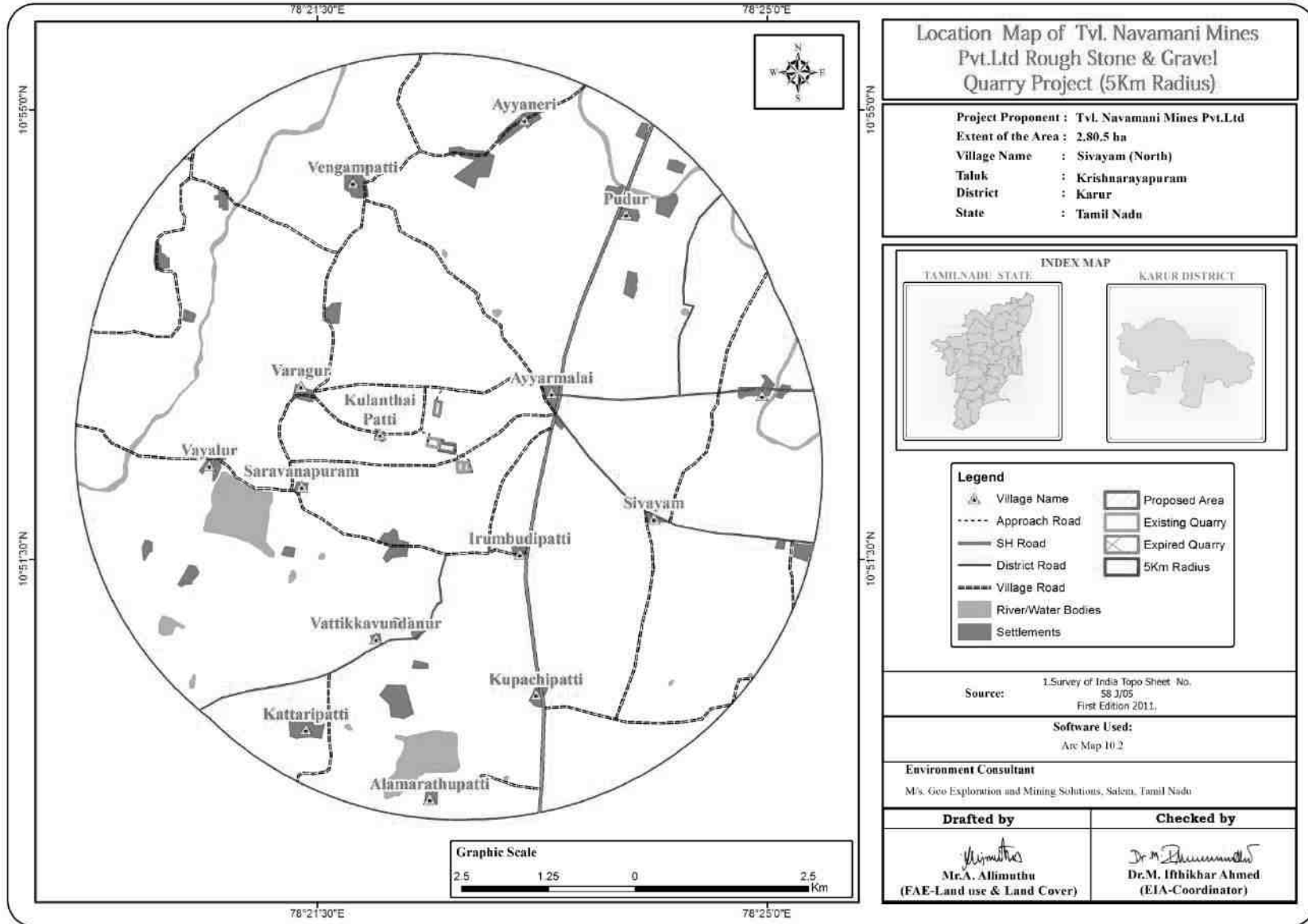
FIGURE 2.7: IMAGE SHOWING SURFACE FEATURES AROUND 1 KM RADIUS
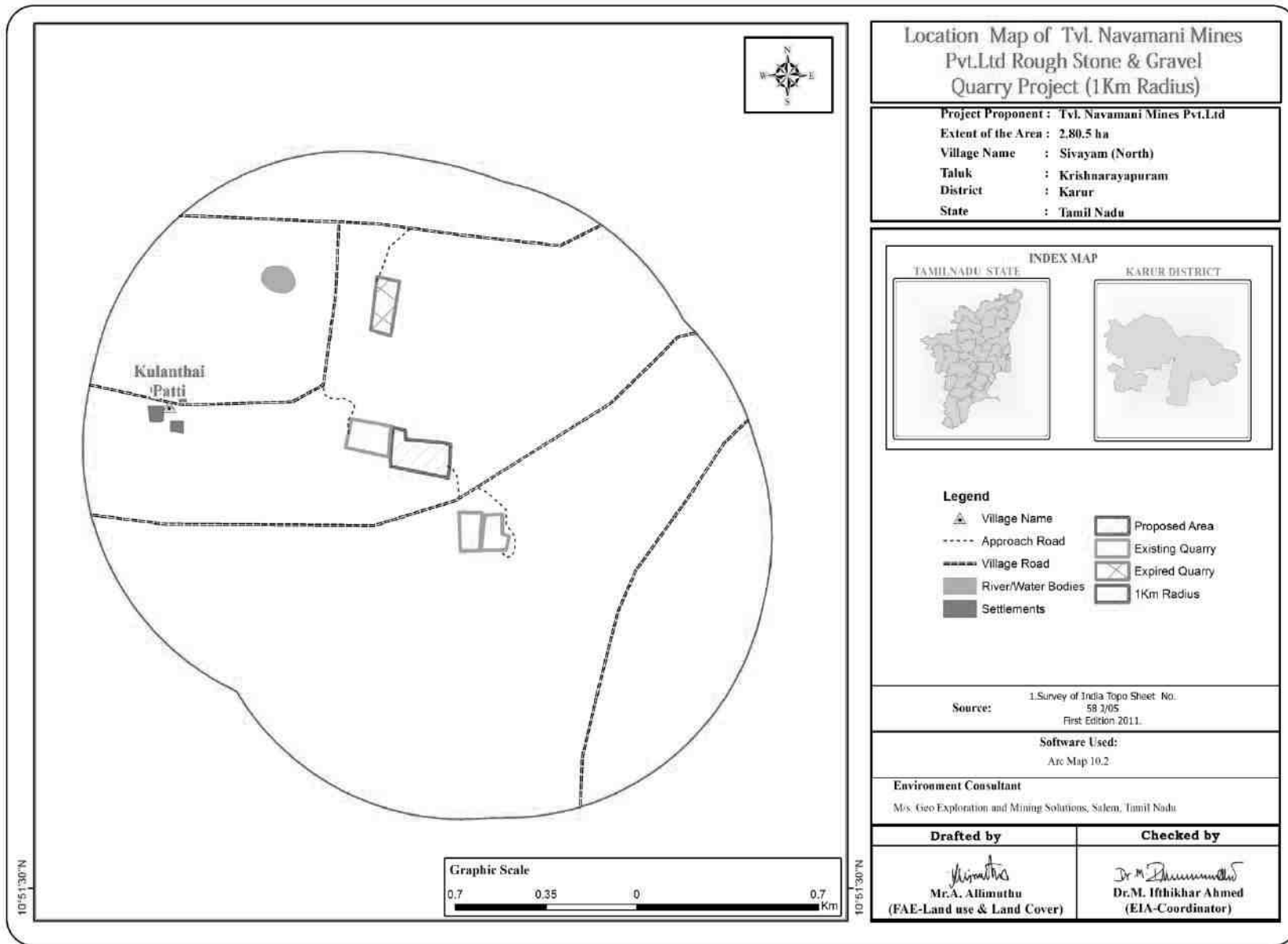
2.2.1   Project Area

- The project area is an Existing quarry now applied for quarrying Rough Stone & Gravel by opencast mechanized method of mining and the project is site specific
- There is No beneficiation or processing proposed inside the project area.
- Highest elevation is 124m AMSL. The general Gradient of the area is south.
- There is no forest land involved in the proposed project area and the area is devoid of major cultivation and trees.

TABLE 2.3: LAND USE PATTERN OF THE PROPOSED PROJECTS

DESCRIPTION	PRESENT AREA IN (HA)	AREA AT THE END OF LIFE OF QUARRY (HA)
Area under quarry	0.10.0	2.25.3
Infrastructure	Nil	0.01.0
Roads	Nil	0.02.0
Green Belt	Nil	0.28.6
Un – utilized area	2.70.5	0.23.6
TOTAL	**2.80.5**	**2.80.5**

Source: Approved Mining plan

2.2.2   Size or Magnitude of Operation

TABLE 2.4: OPERATIONAL DETAILS

PARTICULARS	DETAILS	
	Rough Stone (5Year Plan period)	Gravel (3 Years Plan period)
Geological Resources	9,80,455 m³	84,039 m³
Mineable Reserves	3,95,935 m³	49,332 m³
Yearwise production	3,95,935 m³	49,332 m³
Mining Plan Period / Lease Applied Period	5 Years	
Number of Working Days	300 Days	
Production per day	264 m³	55 m³
No of Lorry loads (6m³ per load)	44 Nos	9 Nos
Proposed Depth for Mining Plan Period	35 m	3 m
Total Depth of Mining	38 meters	

Source: Approved Mining plan and estimation of resources

2.3   GEOLOGY

2.3.1   Regional Geology

Geologically, the entire district can be classified into hard rock and sedimentary formations. Hard rock Formation: - More than 90 percent of the district is underlain by hard rock of Archaean age. The gneissic type of Formation is the major formation among the various types of hard rocks. Charnockite occurs in this district as pockets in Karur and Aravakurichi taluks. Quartzites which are resistant to weathering are also seen as patches in Charnockite and gneissic varieties *(Source District survey Report – Karur - 2017)*

The general geological sequences of the rocks in this area are given below:

```
AGE                     FORMATION
Recent              -    Quaternary formation (Gravel)
        ---------Unconformity-----------
Archaean            -    Charnockite
                         Peninsular Gneiss complex
```
(Source Approved Mining plan)

2.3.2   Local Geology:-

The study area follows the regional trend and mainly comprises of Hard Rock Formation as a homogeneous formation / Batholith formation of Charnockite. The topography of the area is almost plain terrain having gentle slope towards South West side, the area is covered by Gravel formation which is about 3m thickness, followed by the Gravel formation massive charnockite is found it is revealed from the existing quarry pits within the area.

Peninsular gneiss forms the oldest rock formation, in which the massive formation of Charnockite lies over with rich accumulation of recent quaternary formation. On regional scale the Charnockite body trending $N80^0W$ – $S80^0E$ with vertical dip *(Source Approved Mining plan)*

Exploration studies

State Geology and Mining Department has carried out the Regional prospecting and exploration in these areas during 1992 to 1993

Geological survey of India has carried out detailed mapping in Karur District, besides the Functional Area Experts (FAE) in Geology and Hydrogeology carried out detailed Geological studies in the area. The Rough stone formation is clearly inferred from the existing pits and outcrops in the surrounding area.

2.3.3   Hydrogeology

The occurrence and movement of groundwater in hard rock formations are restricted to the porous zones of weathered formations and the open systems of fractures, fissures and joints. Generally, in hard rock regions, occurrence of weathered thickness is discontinuous both in space and depth. Hence recharge of groundwater in hard rock formations is influenced by the intensity and depth of weathering. The subsurface lithological condition and the aquifer characters can be ascertained by drilling exploratory boreholes and conducting pump tests.

The State Ground and Surface Water Resources Data Centre, during the course of investigation has drilled more than 85 boreholes spread over the entire district to find out the nature and behaviour of the subsurface material and their water holding and water yielding capability. There is considerable diversity in the nature of formalities even within the short distance. The lithology of the boreholes indicate that in Kulithalai and Krishnarayapuram taluks, there is considerable thickness of weathering ranging from 16m to 20 m below ground level. The sedimentary tract of Cauvery alluvium is restricted to either side of the river Cauvery and the thickness of Alluvium is estimated to be around 10-12 m.

Aquifer parameters:

More or less, 90 percent of Karur district is covered by crystalline formation of Archaean age. The thickness of aquifer in hard rock formation varies from 15 to 35 m. The inter granular porosity is essentially depend upon the intensity and degree of weathering and fracture development in the bed rock. Deep weathering is developed in gneissic formations and moderate weathering in charnockite formation. The alluvial formation stretches mainly along the river course of Cauvery. *(Source Central Ground Water Board – Karur).*

FIGURE 2.8: REGIONAL GEOLOGY MAP
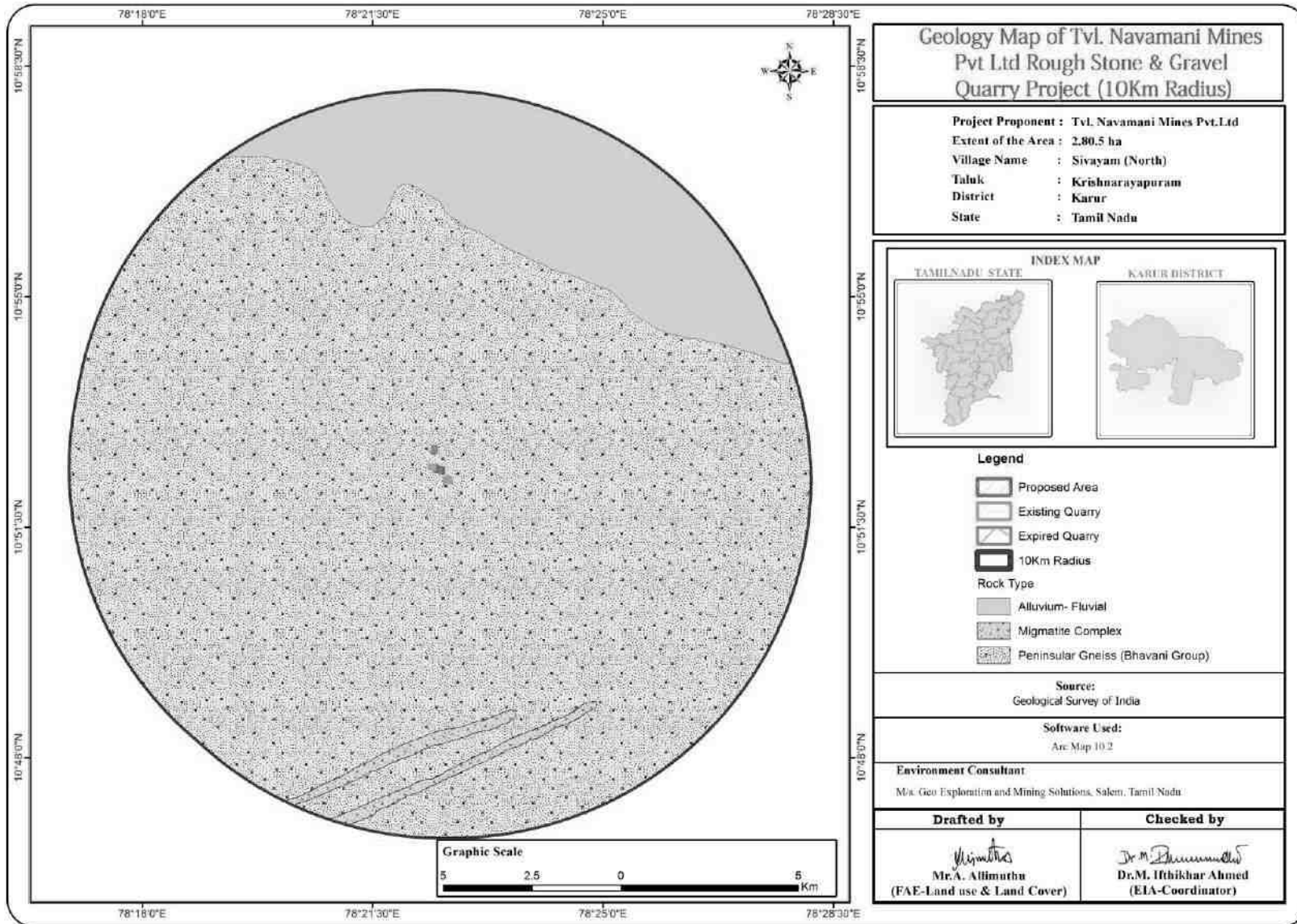
From the above map it is inferred that the cluster quarries falls in the hard rock terrain (Peninsular Gneiss)

FIGURE 2.9: GEOMORPHOLOGY MAP OF THE STUDY AREA
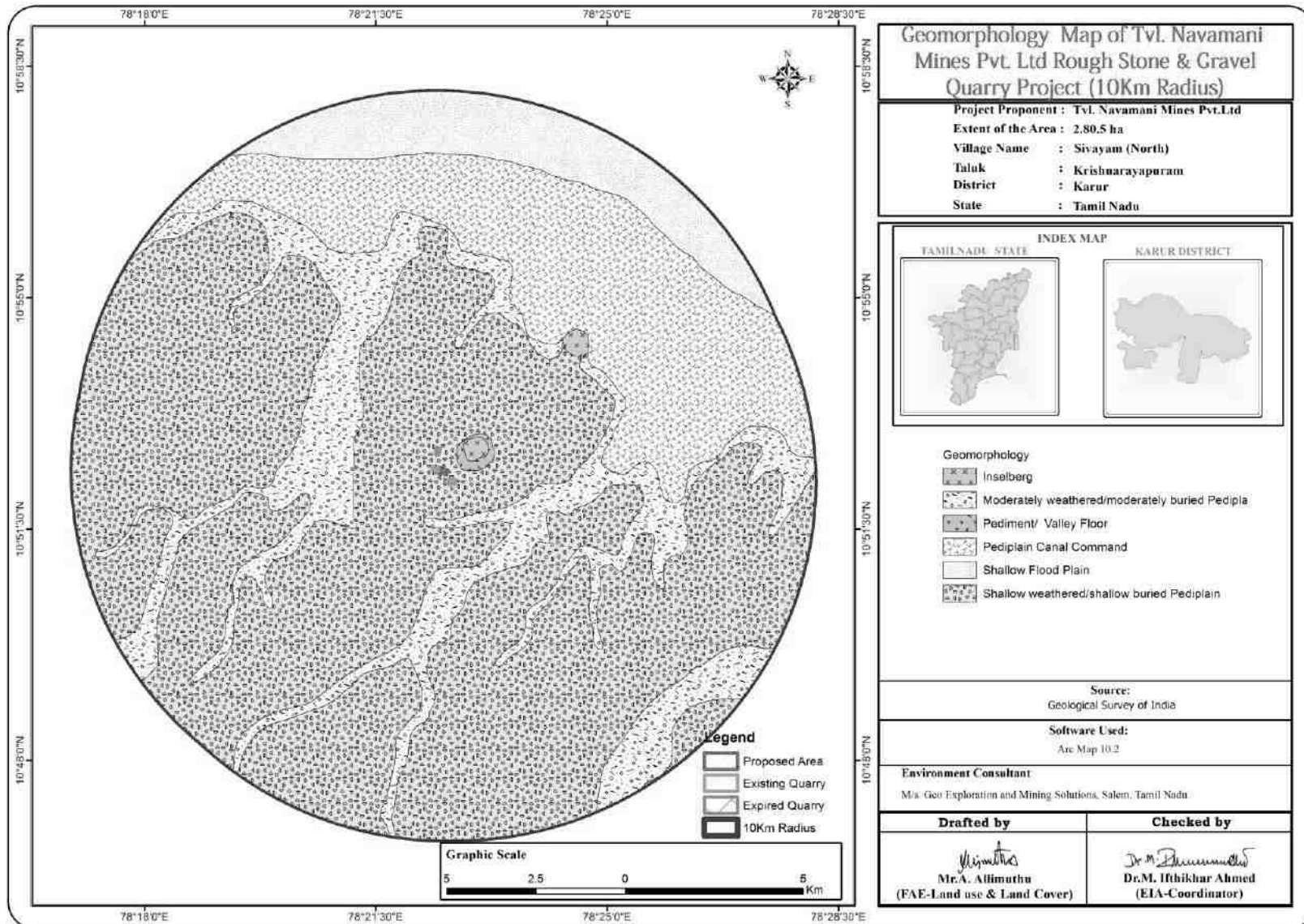
FIGURE 2.10 : TOPOGRAPHY, GEOLOGICAL, YEAR-WISE DEVELOPMENT PRODUCTION PLAN AND SECTION
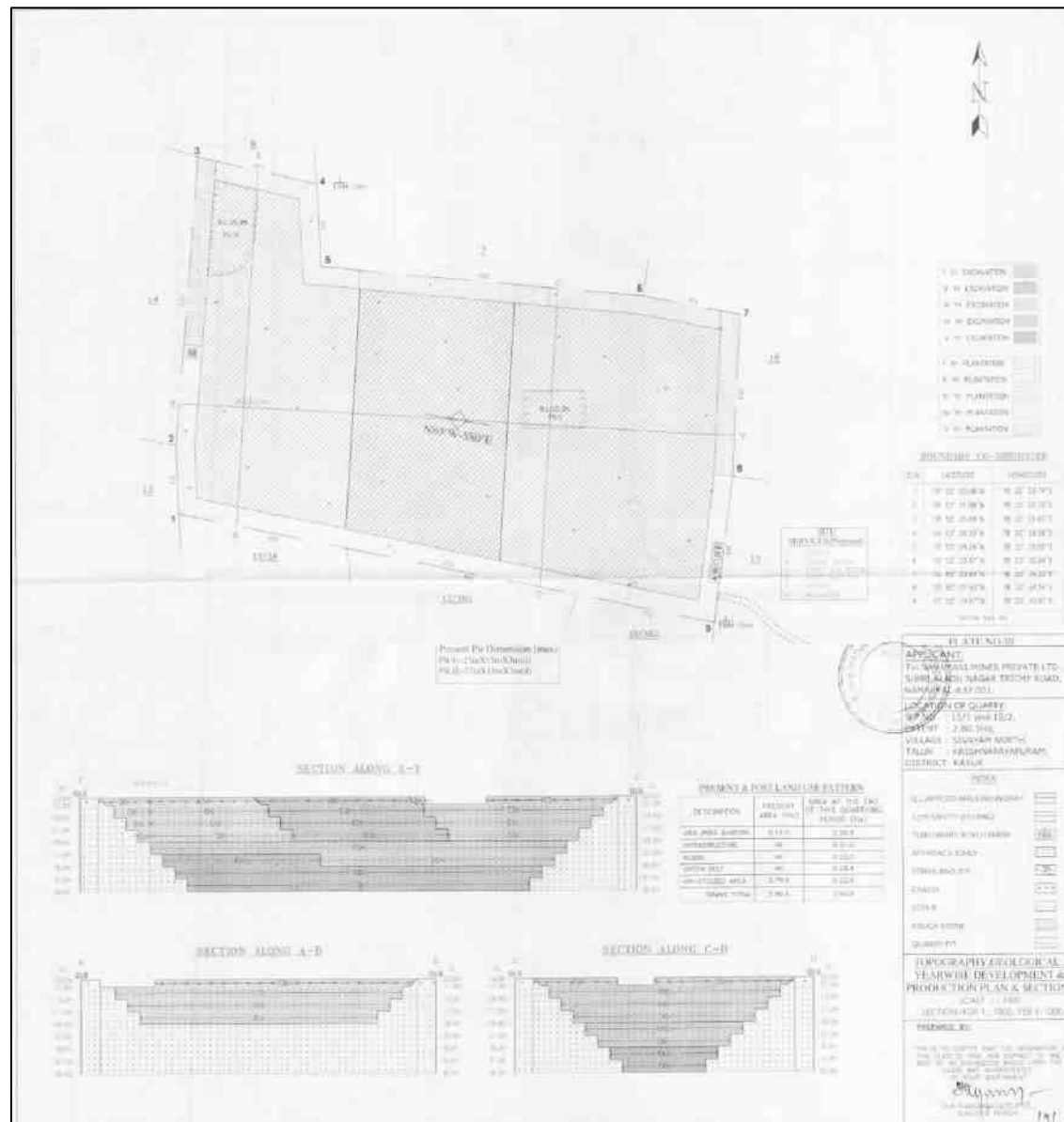
Source: Approved Mining plan

2.4   RESOURCES AND RESERVES

The Resources and Reserves of available Gravel and Rough Stone were calculated based on Cross-Section Method by plotting 3 sections (2 sections width wise & 1 sections length wise) to cover the maximum project area.

Total Geological Resources of Rough Stone   =   **9,80,455 m³**

Total Geological Resources of Gravel   =   **84,039 m³**

Now based on the availability of Geological Resources the Mineable Reserves are calculated by considering excavation system of bench formation and leaving essential safety distance of 7.5 m (Safety Barrier all around the applied area) and deducting the locked up reserves during bench formation (Also called as Bench Loss) and the Mineable Reserves is calculated considering there is no waste / overburden / side burden (100% Recovery Anticipated).

Total Mineable Reserves of Rough Stone   =   **3,95,935 m³**

Total Mineable Reserves of Gravel   =   **49,332 m³**

The above calculated Mineable Reserves is further divided for tentative excavation plan period of the Lease Applied Period = 5 Years

TABLE 2.5: YEAR-WISE PRODUCTION PLAN

YEAR	ROUGH STONE (m³)	GRAVEL (m³)
I	80,380	15,048
II	79,380	16,632
III	82,755	17,652
IV	79,730	-
V	73,690	-
TOTAL	3,95,935	49,332

Source: Approved Mining plan

Disposal of Waste

There is no waste anticipated in this Rough Stone and Gravel quarrying operation. The entire quarried out materials will be utilized (100%).

Conceptual Mining Plan/ Final Mine Closure Plan

Conceptual mining plan is prepared with an object of long term systematic development of benches, layouts, selection of permanent structures, depth of quarrying and ultimate pit dimensions, selection of sites for construction of infrastructure, etc.,

The ultimate pit size is designed based on certain practical parameters such as economical depth of mining, safety zones, permissible area, etc.

TABLE 2.6: ULTIMATE PIT DIMENSIONS

Pit	Length (Max) (m)	Width (Max) (m)	Depth (Max) (m)
I	208	103	38m below ground level

Source: Approved Mining Plan

2.5   METHOD OF MINING

Opencast Mechanized Mining Method is proposed by formation of 5.0 meter height bench with a bench width not less than the bench height. However, as far as the quarrying of Rough Stone is concerned, observance of the provisions of Regulation 106 (2) (b) as above is seldom possible due to various inherent petro genetic factors coupled with mining difficulties. Hence it is proposed to obtain relaxation to the provisions of the above regulation from the Director of Mines Safety for which necessary provision is available with the Regulation 106 (2) (b) of MMR-1961, under Mine Act – 1952.

The top layer of Gravel will be directly excavated by Hydraulic Excavators and loaded into tippers directly and sold to needy customers. The Rough Stone is a batholith formation and the splitting of rock mass of considerable volume from the parent rock mass will be carried out by deploying jackhammer drilling and Slurry Explosives will be used for blasting. Hydraulic Excavators attached with Rock Breakers unit will be deployed for breaking large boulders to required fragmented sizes to avoid secondary blasting and hydraulic excavators attached with bucket unit will be deployed for loading the Rough Stone into the tippers and then the stone is transported from pithead to the nearby crushers.

2.5.1   Drilling & Blasting Parameters

Drilling & Blasting will be carried out as per parameters given below:-

Spacing	– 1.2m
Burden	– 1.0 m
Depth of hole	– 1.5 m
Charge per hole	– 0.5 kg
Powder factor	– 6.0 tonnes/kg
Diameter of hole	– 32 mm

No of Holes to be drilled per day:-

Volume of Rough Stone will be excavated from one hole	=	6 Tonnes
Total Volume	=	3, 95,935 m^3
	=	3, 95,935 /5
	=	79,187/300
	=	264*2.6
	=	686 Tonnes per day
Therefore, Number of Holes per day	=	686/6
	=	114 kg of Explosives
Total quantity of Explosives / Hole	=	0.5 Kg
Hence total No of holes to be drilled	=	228 No of Holes per day
Holes per day		

Type of Explosives to be used –

Slurry explosives (An explosive material containing substantial portions of a liquid, oxidizers, and fuel, plus a thickener), NONEL / Electric Detonator & Detonating Fuse

Storage of Explosives –

No proposal for storage of explosives within the project area, the proponent has made agreement with Thiru. P.Ganesan (authorized explosives agencies) situated in S.F. No 23/3, 5 & 6, Thathampatty village, Chidambarampatti Post and Namakkal district holding explosives license No E/HQ/TN/22/140 (E38725).

The explosives will be sourced from the blasting agency on daily basis and the blasting will be carried out under the supervision of competent qualified Blaster and it will be ensured that there shall be no balance of explosive stock; any balance stock will be taken back by the supplier.

Precaution during Drilling and Blasting –

- Preparation of charge and stemming of holes will be done by a qualified person
- Before the shot holes are charged, adequate warning signals will be given
- Controlled blasting will be carried out using Delay detonator to prevent fly rocks and control the ground vibrations
- Proper inspection will be carried out by the blaster at the blasted site (before & after blasting) before giving clearance signal.
- The blasting will be taken up at appointed timing only with sufficient caution to the public, sentries will be posted in haul roads to regulate and restrict the public during blasting hours.

2.5.2   Extent of Mechanization

TABLE 2.7 MACHINERY DETAILS

S.NO.	TYPE	NOS	SIZE/CAPACITY	MOTIVE POWER
1	Jack hammers	10	1.2m to 2.0m	Compressed air
2	Compressor	2	50 HP	Diesel Drive
3	Excavator with Bucket / Rock Breaker Unit	2	150-200 HP	Diesel Drive
4	Tippers	5	20 Tonnes	Diesel Drive

Source: Approved Mining Plans

2.6   GENERAL FEATURES

2.6.1   Existing Infrastructures

Infrastructures like Mine office, Temporary Rest shelters for workers, Latrine and Urinal Facilities will be constructed as per the Mine Rule after the grant of quarry lease.

2.6.2   Drainage Pattern

There are no streams, canals or water bodies crossing within the project area, hence there is no requirement of stream or canals diversion.

2.6.3   Traffic Density

The traffic survey conducted based on the transportation route of material, the Rough Stone and Gravel is proposed to be transported mainly through the SH 71 (Kulithalai - Manapparai) road located 1.3 km East side of the area and Irumboothipatti – Mylampatti Village road 2.5km South side.

Traffic density measurements were performed at three locations

1. SH 71 (Kulithalai - Manapparai) road located 1.3km East side
2. Village road located 2.5 km South   side

Traffic density measurement were made continuously for 24 hours by visual observation and counting of vehicles under three categories, viz., Heavy motor vehicles, light motor vehicles and two/three wheelers. As traffic densities on the roads are high, two skilled persons were deployed simultaneously at each station during each shift- one person on either direction for counting the traffic. At the end of each hour, fresh counting and recording was undertaken.

GEO EXPLORATION AND MINING SOLUTIONS

FIGURE.2.11: MINERAL TRANSPORTATION ROUTE MAP
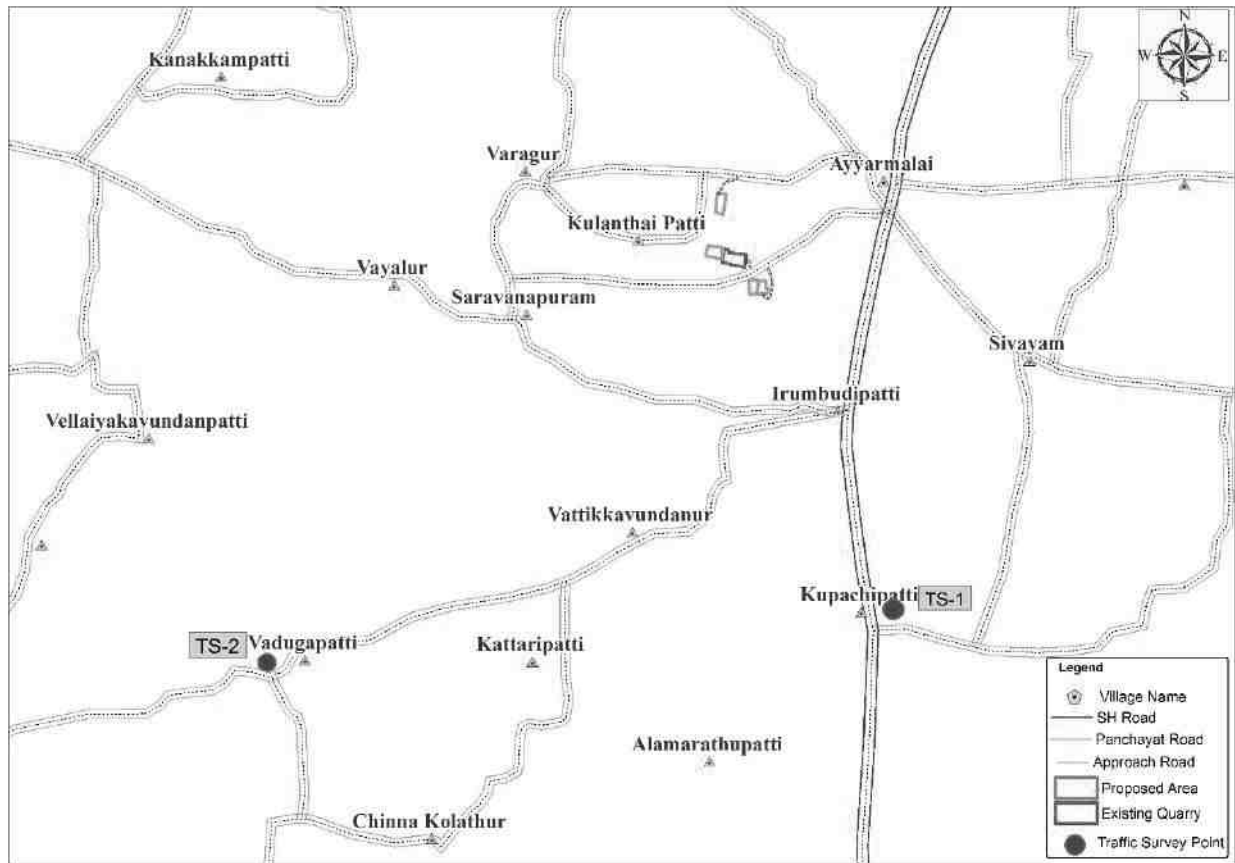
TABLE.2.8: TRAFFIC SURVEY LOCATIONS

Station Code	Road Name	Distance and Direction	Type of Road
TS1	SH 71 (Kulithalai - Manapparai)	1.3 km – East	Major District Road (Two Lane)
TS2	Village Road	2.5 km South	Village road (Single Lane)

Source: On-site monitoring by GEMS FAE & TM

TABLE 2.9: EXISTING TRAFFIC VOLUME

Station code	HMV		LMV		2/3 Wheelers		Total PCU
	No	PCU	No	PCU	No	PCU	
TS1	155	465	350	350	285	143	958
TS2	41	123	46	46	120	60	229

Source: On-site monitoring by GEMS FAE & TM

* PCU conversion factor: HMV (Trucks and Bus) = 3, LMV (Car, Jeep and Auto) = 1 and 2/3 Wheelers = 0.5

TABLE 2.10: ROUGH STONE HOURLY TRANSPORTATION REQUIREMENT

Transportation of Rough Stone and Gravel per day			
Capacity of trucks	No Trips per day Cumulatively	Volume in PCU	PCU Per hour considering 8 HOURS
20 tonnes	53	53	53

Source: Data analysed from Approved Mining plan

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TABLE 2.11: SUMMARY OF TRAFFIC VOLUME

Route	Existing Traffic volume in PCU	Incremental traffic due to the project	Total traffic volume	Hourly Capacity in PCU as per IRC – 1960 guidelines
SH 71 (Kulithalai - Manapparai)	958	53	1011	1500
Village Road	229	53	282	1200

Source: On-site monitoring analysis summary by GEMS FAE & TM

- Due to this projects the existing traffic volume will not exceed
- As per the IRC 1960 this existing village road can handle 1,200 PCU in hour and Major district road can handle 1500 PCU in hour hence there will not be any conjunction due to this proposed transportation.

2.6.4   Mineral Beneficiation and Processing

There is no proposal for the mineral processing or ore beneficiation in this project

2.7   PROJECT REQUIREMENT

2.7.1   Water Source & Requirement

Detail of water requirements in KLD as given below:

TABLE 2.12 WATER REQUIREMENT FOR THE PROJECT

*Purpose	Quantity	Source
Dust Suppression	1.5 KLD	Rainwater accumulated in Mine Pit/ Water Tanker
Green Belt development	1.0 KLD	Rainwater accumulated in Mine Pit/ Water Tanker
Drinking and Domestic purpose	1.5 KLD	Approved Water vendors
Total	**4.0 KLD**	

Source: Prefeasibility report

* Drinking water will be sourced from Approved Water Vendors

2.7.2   Power and Other Infrastructure Requirement

The project does not require power supply for the mining operations. The quarrying activity is proposed during day time only (General Shift 8 AM – 5 PM, Lunch Break 1 PM – 2 PM). Electricity for use in office and other internal infrastructure will be obtained from SEB.

The temporary infrastructures such as Mine Office, First Aid Room, Rest Shelter etc., will be constructed within the project area before commencing the quarry operation. No workshops are proposed inside the project area hence there will not be any process effluent generation from the proposed lease area. Domestic effluent from the mine office will be discharged to septic tank and soak pit. There is no toxic effluent expected to generate in the form of solid, liquid or gaseous form hence there is no requirement of waste treatment plant.

2.7.3   Fuel Requirement

High speed Diesel (HSD) will be used for mining machineries. Diesel will be brought from nearby Fuel Stations.

Total diesel consumption is around   =   500 Liters of HSD / day

2.8   EMPLOYMENT REQUIREMENT:

The skilled, competent qualified statutory persons will be engaged for quarrying operation, preference will be given to the local community.

TABLE 2.13: EMPLOYMENT POTENTIAL FOR THIS PROPOSAL

SL.NO.	DESCRIPTION	NUMBERS
	Skilled Labour	
1	Mines Foreman	1
2	Blaster/mate	1
3	Excavator – operator & Driver	7
4	Jack hammer operator	20
	Ordinary employees	
5	Helper	3
6	Cleaner	3
7	Watchman	1
	TOTAL	**36**

Source: Approved Mining Plan

2.9   PROJECT IMPLEMENTATION SCHEDULE

The commercial operation will commence after the grant of Environmental Clearance. CTO will be obtained from the Tamil Nadu State Pollution Control Board. The conditions imposed during the Environmental Clearance will be compiled before the start of mining operation.

TABLE 2.14 EXPECTED TIME SCHEDULE

Sl.No.	Particulars	Time Schedule (In Month)					Remarks if any
		1st	2nd	3rd	4th	5th	
1	Environmental Clearance	▓	▓				
2	Consent to Operate			▓			Production Start Period
Time line may vary; subjected to rules and regulations /& other unforeseen circumstances							

Source: Anticipated based on Timelines framed in EIA Notification & CPCB Guidelines

3.   DESCRIPTION OF ENVIRONMENT

3.0   GENERAL

This chapter presents a regional background to the baseline data at the very onset, which will help in better appreciation of micro-level field data, generated on several environmental and ecological attributes of the study area. The baseline status of the project environment is described section wise for better understanding of the broad spectrum conditions. The baseline environment quality represents the background environmental scenario of various environmental components such as Land, Water, Air, Noise, Biological and Socio-economic status of the study area. Field monitoring studies to evaluate the base line status of the project site were carried out covering March,April & May 2021 with CPCB guidelines. Environmental data has been collected with reference to cluster quarries by KGS ENVIRO LABORATORY PVT LTD., ISO /IEC 17025:2017Certified & MoEF Notified Laboratory, for the below attributes –

- Land
- Water
- Air
- Noise
- Biological
- Socio-economic status

Study Area

An area of 10 km radius (aerial distance) from the periphery of the cluster is considered for EIA study. The data collection has been used to understand the existing environment scenario around the cluster against which the potential impacts of the project can be assessed. The study area has been divided into two zones viz **core zone** and **buffer zone** where core zone is considered as cluster quarries area and buffer zone taken as 10km radius from the periphery of the Cluster quarries. Both Core zone and Buffer zone is taken as the study area.

Study Period

The baseline study was conducted during the pre-monsoon season i.e. March,April & May 2021

Study Methodology

- The project area was surveyed in detail with the help of Total Station and the boundary pillars were picked up with the help of GPS. The boundary coordinates were superimposed on the satellite imagery to understand the relief of the area, besides Land use pattern of the area was studied through the Bhuvan (ISRO)
- Soil samples were collected and analysed for relevant physio-chemical characteristics, exchangeable Cations, nutrients & micro nutrients etc., in order to assess the impact due to mining activities and to recommend saplings for Greenbelt development
- Ground water samples were collected during the study period from the existing bore wells, while surface water was collected from ponds in the buffer zone. The samples were analysed for parameters necessary to determine water quality (based on IS: 10500:2012 criteria) and those which are relevant from the point of view of environmental impact of the proposed mines
- A onsite meteorological station was setup in cluster area, to collect data about wind speed, wind direction, temperature, relative humidity, rainfall and general weather conditions were recorded throughout the study period
- In order to assess the Ambient Air Quality (AAQ), samples of ambient air were collected by installation of Respiratory Dust Samplers (RDS) for Fugitive dust, PM_{10} and SO_2, NO_X with gaseous attachments & Fine Dust Samplers (FDS) for $PM_{2.5}$ and other parameters as per NAAQ norms and analysed for primary air pollutants to work out the existing status of air quality
- The Noise level measurements were also made at various locations in different intervals of time with the help of sound level meter to establish the baseline noise levels in the impact zone

- Baseline biological studies were carried out to assess the ecology of the study area to study the existing flora and fauna pattern of the area
- Socio-Economic survey was conducted at village and household level in the study area to understand the present socio-economic conditions and assess the extent of impact due to the proposed mining project

The sampling methodologies for the various environmental parameters required for the study, frequency of sampling, method of samples analysis, etc., are given below Table 3.1.

TABLE 3.1: MONITORING ATTRIBUTES AND FREQUENCY OF MONITORING

Attribute	Parameters	Frequency of Monitoring	No. of Locations	Protocol
Land-use Land cover	Land-use Pattern within 10 km radius of the study area	Data's from census handbook 2011 and from the satellite imagery	Study Area	Satellite Imagery Primary Survey
*Soil	Physio - Chemical Characteristics	Once during the study period	4 (1 core & 3 buffer zone)	IS 2720 Agriculture Handbook - Indian Council of Agriculture Research, New Delhi
*Water Quality	Physical, Chemical and Bacteriological Parameters	Once during the study period	6 (2 surface water & 4 ground water)	IS 10500& CPCB Standards
Meteorology	Wind Speed Wind Direction Temperature Cloud cover Dry bulb temperature Rainfall	1 Hourly Continuous Mechanical/Automatic Weather Station	1	Site specific primary data & Secondary Data from IMD Station
*Ambient Air Quality	PM_{10} $PM_{2.5}$ SO_2 NO_X Fugitive Dust	24 hourly twice a week (March to May 2021)	8 (2 core & 6 buffer)	IS 5182 Part 1-23 National Ambient Air Quality Standards, CPCB
*Noise Levels	Ambient Noise	Hourly observation for 24 Hours per location	8 (4 core & 4 buffer zone)	IS 9989 As per CPCB Guidelines
Ecology	Existing Flora and Fauna	Through field visit during the study period	Study Area	Primary Survey by Quadrate & Transect Study Secondary Data – Forest Working Plan
Socio Economic Aspects	Socio–Economic Characteristics, Population Statistics and Existing Infrastructure in the study area	Site Visit & Census Handbook, 2011	Study Area	Primary Survey, census handbook & need based assessments.

Source: On-site monitoring/sampling by KGS Laboratories in association with GEMS

* All monitoring and testing has been carried out as per the Guidelines of CPCB and MoEF & CC

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3.1 LAND ENVIRONMENT

The main objective of this section is to provide a baseline status of the study area covering 10km radius around the proposed mine site so that temporal changes due to the mining activities on the surroundings can be assessed in future.

3.1.1 Land Use/ Land Cover

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.

TABLE 3.2: LAND USE / LAND COVER TABLE 10 KM RADIUS

Sl. No.	Classification	Area In Ha	Area in %
1	Builtup, Rural	322.14	1.0
2	Builtup Mining	60.05	0.2
3	Agricultural, Crop Land	16363.70	51.1
4	Agricultural, Plantation	2480.42	7.7
5	Agriculture, Fallow	8198.36	25.6
6	Forest Plantation	651.15	2.0
7	Barren/Waste.,/ Scrub land	1455.91	4.5
8	Wetland/Water.,/River/Stram/Canals	2046.78	6.4
9	Wetland/Water.,/Reservoir/LakePonds	434.77	1.4
	Total	**32013.34**	**100.00**

Source: Survey of India Toposheet and Landsat Satellite Imagery

FIGURE 3.1: LAND USE LAND COVER MAP 10KM RADIUS

Land Use and Land Cover Map of Tvl. Navamni Mines Rough Stone & Gravel Quarry Project (10 Km Radius)

Project Proponent : Tvl. Navamani Mines Pvt.Ltd
Extent of the Area : 2.80.5 ha
Village Name : Sivayam (North)
Taluk : Krishnarayapuram
District : Karur
State : Tamil Nadu

Classes	Classes
Built Up	**Grass / Grazing**
Urban	Grass/Grazing
Rural	**Barren / Waste Lands**
Mining	Salt Affected Land
Agricultural Land	Gullied /Ravinous Land
Crop Land	Scrub Land
Agricultural Plantation	Sandy Area
Fallow Land	Barren Rocky
Current Shifting Cultivation	Rann
	Wetlands / Water bodies
Forest	Water bodies
Evergreen/ Semi Evergreen	Rivers/Streams/Canals
Deciduous	Inland Wetland
Forest Plantation	Coastal Wetland
Scrub Forest	**Snow and Glaciers**
Swamp/ Mangroves	Snow/Glaciers

Legend

Proposed Quarries

Existing Quarries

10Km Radius

Source:
Bhuvan https://bhuvan-appl.nrsc.gov.in/state/TN

Software Used:
Arc Map 10.2

Environment Consultant
M/s. Geo Exploration and Mining Solutions, Salem, Tamil Nadu

Drafted by	Checked by
Mr.A. Allimuthu (FAE-Land use & Land Cover)	Dr.M. Ifthikhar Ahmed (EIA-Coordinator)

Graphic Scale

5   2.5   0   5 Km

FIGURE 3.2: PIE DIAGRAM OF LAND USE AND LAND IN STUDY AREA
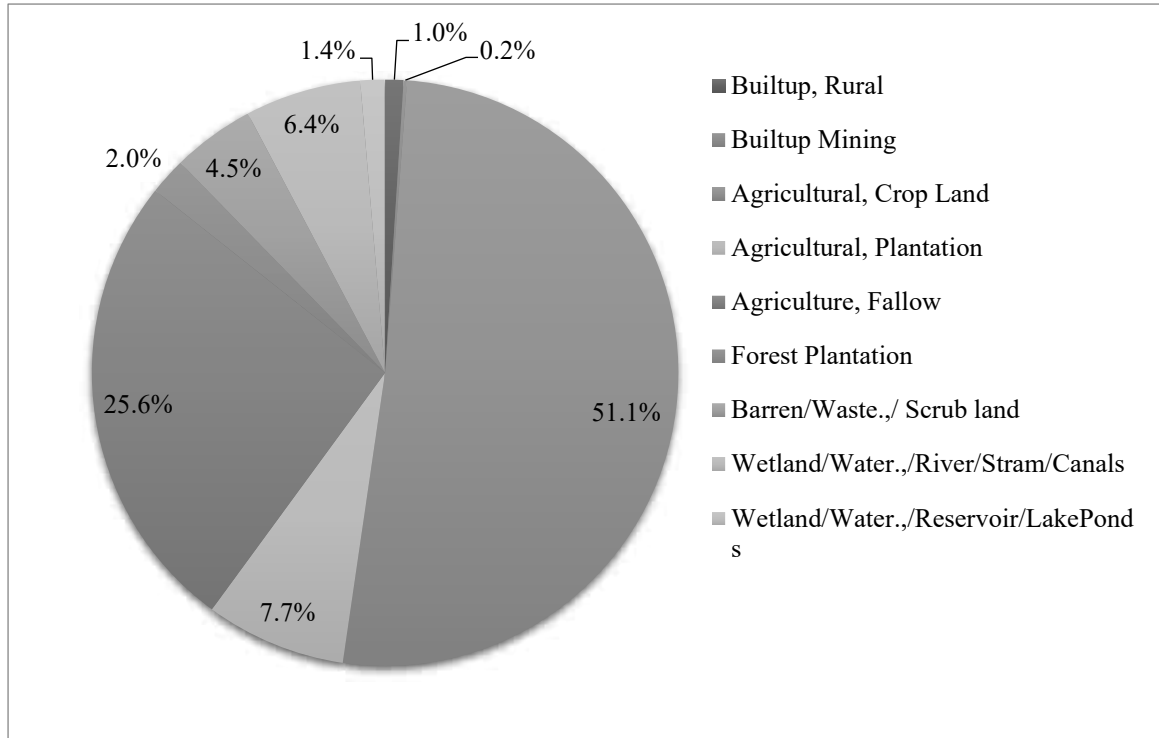
Source: Table 3.2

From the above table and pie diagram it is inferred that the majority of the land in the study area is Agriculture land (includes crop land) 84.4 % followed by water bodies (Rivers Stream Canals) 7.8 %.

The total mining area within the study area is 60.05 ha i.e., 0.2 %. The cluster area of 8.80.0 ha contributes about 14.65 % of the total mining area within the study area. This small percentage of Mining Activities shall not have any significant impact on the environment.

3.1.2   Topography

The project area is almost plain terrain with gentle gradient towards South west; maximum elevation of the area is 124m above AMSL. Aiyar malai is located about 400m from the East side of the project area altitude of the project 317m AMSL.

3.1.3   Drainage Pattern of the Area

There are no developed surface drainage channels in the study area. Cauvery River passing in the study area is about 9km North side. The area is studded with few tanks that serve as the source of drinking water and also their surplus feeds adjoining tanks. The area is mostly dry in all seasons except rainy seasons.

The general drainage pattern of the area is of sub dendritic and dendritic pattern. No prominent water course or nallah is inferred. During rainy season the surface runoff flows in West to East direction. The drainage pattern of the study area is given in Fig. 3.5. The quarrying activity will not hinder the natural flow of rainwater.

3.1.4   Seismic Sensitivity

The proposed project site falls in the seismic Zone II (Least active), low damage risk zone as per BMTPC, Vulnerability Atlas of Seismic zone of India IS: 1893 – 2002. The project area falls in the hard rock terrain on the peninsular shield of south India which is highly stable.

3.1.5   Environmental Features in the Study Area

There is no Wildlife Sanctuaries, National Park and Archaeological monuments within cluster area. No Protected and Reserved forest area is involved in the cluster area. Therefore, there will be no need to acquisition/diversion of forest land. The details related to the environment sensitivity around the cluster area i.e. 10km radius, are given in the below Table 3.3.

TABLE 3.3: DETAILS OF ENVIRONMENT SENSITIVITY AROUND THE CLUSTER

Sl.No	Sensitive Ecological Features	Name	Arial Distance in km from Cluster
1	National Park / Wild life Sanctuaries	None	Nil within 10 km Radius
2	Reserve Forest	None	Nil within 10 km Radius
3	Lakes/Reservoir/ Dams/Stream/Rivers	Odai	100m South, 390m South West and 340m North East
		Irumbothipatti tank	2.5 km South East
		Vayalur Kulam	2.5 km South West
		Pappakkalpatti Tank	4.0 km South
		Kattakali High level canal	4.5 km North East
		Nallur Tank	9.0 km South East
		Cauvery River	9.0 km North
4	Tiger Reserve/ Elephant Reserve/ Biosphere Reserve	None	Nil within 10KM Radius
5	Critically Polluted Areas	None	Nil within 10 km Radius
6	Mangroves	None	Nil within 10 km Radius
7	Mountains/Hills	None	Nil within 10 km Radius
8	Notified Archaeological Sites	None	Nil within 10 km Radius
9	Industries/ Thermal Power Plants	None	Nil within 10 km Radius
10	Defence Installation	None	Nil within 10 km Radius

Source: Survey of India Toposheet

TABLE 3.4: LIST OF INDUSTRIES AROUND THE CLUSTER

Industries	Distance and Direction
Aptech Engineering Industries (Metal Fabrications)	8.0 Km SE
Jay Industries, Iron works	8.0 km NE
Modern Industries Phase II	8.2 Km NE

Source: Satellite Imageries and Field Survey

3.1.6   Soil Environment

Soil quality of the study area is one of the important components of the land environment. The composite soil samples were collected from the study area and analysed for different parameters. The locations of the monitoring sites are detailed in Table 3.6 and Figure 3.3.

The objective of the soil sampling is -

To determine the baseline soil characteristics of the study area; study the impact of proposed activity on soil characteristics and study the impact on soil more importantly agriculture production point of view.

TABLE 3.5: SOIL SAMPLING LOCATIONS

S. No	Location code	Monitoring Locations	Distance & Direction	Coordinates
1	S-1	Project Area	North East Corner	10°52'21.40"N 78°22'31.70"E
2	S-2	Kuzanthai Patti	1.50 Km South West	10°51'57.30"N 78°20'55.60"E
3	S-3	Kuzanthai Patti	0.80 Km South West	10°52'14.80"N 78°22'02.20"E
4	S-4	Iyermali	1.50Km North East	10°51'36.90"N 78°22'04.70"E

Source: On-site monitoring/sampling by KGS Laboratories in association with GEMS

Methodology –

For studying soil quality, sampling locations were selected to assess the existing soil conditions in and around the project site representing various land use conditions. The samples were collected by auger boring into the soil up to 90-cm depth. Four (4) locations were selected for soil sampling on the basis of soil types, vegetative cover, industrial & residential activities including infrastructure facilities, which would accord an overall idea of the soil characteristics. The samples were analysed for physical and chemical characteristics. The samples were sent to laboratory for analysis. The samples were filled in Polythene bags, coded and sent to laboratory for analysis and the details of methodology in respect are given in below Table 3.5.

TABLE 3.6: METHODOLOGY OF SAMPLING COLLECTION

Particulars	Details
Frequency	One grab sample from each station-once during the study period
Methodology	Composite grab samples of the topsoil were collected from 3 depths, and mixed to provide a representative sample for analysis. They were stored in airtight Polythene bags and analysed at the laboratory.

Source: On-site monitoring/sampling by KGS Laboratories in association with GEMS

Soil Testing Result –

The samples were analysed as per the standard methods prescribed in "Soil Chemical Analysis (M.L. Jackson, 1967) & Department of Agriculture, Cooperation & Farmers Welfare, Ministry of Agriculture & Farmers Welfare, Government of India". The important properties analysed for soil are bulk density, porosity, infiltration rate, pH and Organic matter, kjeldahi Nitrogen, Phosphorous and Potassium. The standard classifications of soil and physico-chemical characteristics of the soils are presented below in Table 3.6 & Test Results in Table 3.7.

FIGURE 3.3: SOIL SAMPLING LOCATIONS AROUND 10 KM RADIUS

Soil Sampling Location Map of
Tvl. Navamani Mines Pvt Ltd
Rough Stone & Gravel
Quarry Project (5 Km Radius)

Project Proponent : Tvl. Navamani Mines Pvt.Ltd
Extent of the Area : 2.80.5 ha
Village Name : Sivayam (North)
Taluk : Krishnarayapuram
District : Karur
State : Tamil Nadu

S. No	Location code	Monitoring Locations	Distance & Direction	Coordinates
1	S-1	Project Area	NorthWest Corner	10°52'24.03"N 78°22'28.55"E
2	S-2	Kuzanthai Patti	800m Soth West	10°52'19.60"N 78°21'59.32"E
3	S-3	Kuzanthai Patti	1.5 Km South West	10°51'37.09"N 78°22'00.62"E
4	S-4	Iyermali	1.5Km North East	10°52'35.02"N 78°23'26.40"E

Legend
- Soil Sampling Location
- Proposed Area
- Existing Quarry
- 5Km Radius

Source:
1. Survey of India Topo Sheet: No.58 J/05. First Edition 2011.

Software Used:
2. Arc Map 10.2, 2.Global Mapper 15

Environment Consultant
M/s. Geo Exploration and Mining Solutions, Salem, Tamil Nadu

Drafted by	Checked By
Mr.A. Allimuthu (FAE-Land use & Land Cover)	Dr.M. Ifthikhar Ahmed (EIA-Coordinator)

FIGURE 3.4: SOIL MAP

TABLE 3.7: SOIL QUALITY OF THE STUDY AREA

S.No	Parameters	Units	S1	S2	S3	S4
1	pH at 27°C	-	8.21	8.02	7.96	8.09
2	Electrical Conductivity@25°C	µs/cm	344.2	356.8	310.5	255.6
3	Texture	-	Clay Loam	Clay Loam	Clay Loam	Clay Loam
4	Sand	%	34.9	32.9	31.6	28.3
5	Slit	%	39.8	35.5	33.7	35.9
6	Clay	%	25.3	31.6	34.7	35.8
7	Water Holding Capacity	%	44.3	40.5	42.5	36.6
8	Bulk Density	g/cc	1.09	1.12	1.23	1.06
9	Porosity	%	21.8	20.1	18.3	19.5
10	Exchangeable Calcium (as Ca)	mg/Kg	157	112	151	199
11	Exchangeable Magnesium (as Mg)	mg/Kg	17.3	14.5	11.2	21.3
12	Exchangeable Manganese (as Mn)	mg/Kg	37.9	34.3	37.5	34.2
13	Exchangeable Zinc as Zn	mg/Kg	0.51	0.37	20.2	20.5
14	Available Boron (as B)	mg/Kg	0.49	0.67	0.27	0.39
15	Soluble Chloride (as Cl)	mg/Kg	188	169	151	159
16	Soluble Sulphate (as S04)	mg/Kg	145	137	107	98.6
17	Available Potassium (as K)	mg/Kg	41	28.9	46.3	51.2
18	Available Phosphorous (as P)	Kg/hec	1.09	1.54	1.56	1.13
19	Available Nitrogen(as N)	Kg/hec	149	162.4	173	188.3
20	Cadmium (as Cd)	mg/Kg	ND	ND	ND	ND
21	Chromium (as Cr)	mg/Kg	ND	ND	ND	ND
22	Copper(as Cu)	mg/Kg	ND	ND	ND	ND
23	Lead (as Pb)	mg/Kg	0.17	0.29	0.24	0.27
24	Total Iron	mg/Kg	2.06	2.63	3.02	2.53
25	Organic Matter	%	2.01	1.74	1.99	1.63
26	Organic Carbon	%	1.17	1.01	1.16	0.95
27	CEC	meq/l00g	39	37.2	36.1	34.5

Source: Sampling Results by KGS Laboratories

Interpretation & Conclusion
Physical Characteristics –

The physical properties of the soil samples were examined for texture, bulk density, porosity and water holding capacity. The soil texture found in the study area is

Clay Loam Soil and Bulk Density of Soils in the study area varied between 1.06 – 1.23 g/cc. The Water Holding Capacity and Porosity of the soil samples is found to be medium i.e. ranging from 36.6 – 44.3 %.

Chemical Characteristics –

- The nature of soil is slightly alkaline to strongly alkaline with pH range 7.96 to 8.21
- The available Nitrogen content range between 149 to 188.3 kg/ha
- The available Phosphorus content range between 1.09 to 1.56 kg/ha
- The available Potassium range between 28.9 to 51.2 mg/kg

Whereas, the micronutrient as zinc (Zn) and iron (Fe) were found in the range of 0.51 to 20.5 mg/kg; 2.06 to 3.02 mg/kg and ND

3.2   WATER ENVIRONMENT

The water resources, both surface and groundwater play a significant role in the development of the area. 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.

3.2.1   Surface Water Resources:

Major water bodies in the study area are Cauvery River is about 9.0 km North. The study area is studded with few tanks that serve as the source of drinking water and also their surplus feeds adjoining tanks. The rainfall over the area is moderate, the rainwater storage in open wells and trenches are in practice over the area and the stored water acts as source of freshwater for couple of months after rainy season.

TABLE 3.8 A: WATER BODIES IN THE BUFFER ZONE

Sl.No.	Water Bodies	Distance and Direction
1	Irumbothipatti Tank	2.5 Km South East
2	Nallur Tank	9.0 Km South East
3	Pappakkapatti Tank	4.0 Km South
4	Vayalur Kulam	2.5 Km South West
5	Punjapatti Kulam	9.0 Km South west
6	Canal(Kattalai High Level Canal)	4.5 Km North East
7	Cauvery River	9.0 Km North

3.2.2   Ground Water Resources:

The terrain is underlain by hard rock formation. Fissured and fractured crystalline rocks constitute the important aquifer systems in the Karur region.

More or less, 90 percent of Karur district is covered by crystalline formation of Archaean age. The thickness of aquifer in hard rock formation varies from 15 to 35 m. The inter granular porosity is essentially depend upon the intensity and degree of weathering and fracture development in the bed rock. Deep weathering is developed in gneissic formations and moderate weathering in charnockite formation. The alluvial formation stretches mainly along the river course of Cauvery.

The study area falls in the Safe block (<70%) which is categorized as over exploited block as per G.O (MS) No 113 dated 09.06.2016. Ground water extraction is not proposed for this project.

There are twenty open wells within the radius of 1km Most of the wells are almost in dry conditions:- The details of the well and depth in monsoon and non-monsoon is described below:

TABLE 3.8B : DETAILS OF OPEN WELL IN 1KM RADIUS

Well	Depth in Meters	Water level in Monsoon in m	Water level in Non Monsoon in m
OW-1	18m	14	16
OW-2	21m	15	18
OW-3	17m	13	16
OW-4	22m	16	dry
OW-5	18m	17	dry
OW-6	dry	dry	dry
OW-7	20m	15	17
OW-8	22m	18	20
OW-9	dry	dry	dry
OW-10	16m	15	dry
OW-11	15m	15	17
OW-12	19m	16	18
OW-13	17m	16	dry
OW-14	16m	14	15
OW-15	18m	16	17
OW-16	16m	13	15
OW-17	22m	16	17
OW-18	19m	14	15
OW-19	15m	13	14
OW-20	18m	14	16
OW-21	19m	16	18
OW-22	21m	15	18
OW-23	22m	16	17
OW-24	20m	15	17
OW-25	22m	16	17
OW-26	20m	15	17
OW-27	dry	dry	dry
OW-28	20m	15	17
OW-29	22m	16	17
OW-30	19m	16	18
OW-31	dry	dry	dry

Source : Data obtained by the FAE & Team Members

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3.2.3   Methodology

Reconnaissance survey was undertaken and monitoring locations were finalized based on;

- Drainage pattern;
- Location of Residential areas representing different activities/likely impact areas; and
- Likely areas, which can represent baseline conditions

Two (2) surface water and Six (4) ground water samples were collected from the study area and were analysed for physio-chemical, heavy metals and bacteriological parameters in order to assess the effect of mining and other activities on surface and ground water. The samples were analysed as per the procedures specified by CPCB, IS-10500:2012 and 'Standard methods for the Examination of Water and Wastewater' published by American Public Health Association (APHA). The water sampling locations are given in Table 3.8 and shown as Figure 3.5.

TABLE 3.9: WATER SAMPLING LOCATIONS

S.NO	CODE	LOCATIONS	DISTANCE & DIRECTION	COORDINATES
SURFACE WATER				
1	SW1	Vayalur Kulam	2.5 km, South West	10°51'57.36"N 78°21'00.04"E
2	SW2	Cauvery River	9.5 km North East	10°57'07.95"N 78°24'34.86"E
GROUND WATER				
3	BW1	Nearest Crusher	300m South	10°52'09.11"N 78°22'31.47"E
4	BW2	Kuzanthaipatti village	0.7 km, SW	10°52'15.00"N 78°22'02.42"E
5	BW3	Kodangipatti village	1.5 km, SW	10°51'41.74"N 78°22'03.29"E
6	BW4	Iyermalai village	1.5 km, NE	10°52'34.31"N 78°23'18.94"E

Source: On-site monitoring/sampling by KGS Laboratories in association with GEMS

TABLE 3.10: GROUND WATER SAMPLING RESULTS

S.No	Parameters	Units	RESULTS				Standards as Per IS 10500: 2012	
			GW1	GW2	GW3	GW4	Acceptable limit	Permissible limit
1	Color	Hazen	< 5	< 5	< 5	< 5	5	5
2	Odour	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
3	Taste	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
4	pH@ 25ºC	-	7.54	8.05	7.94	7.01	6.5-8.5	6.5-8.5
5	Electrical Conductivity 25⁰C	µs/cm	698	786	1074	948		
6	Turbidity	NTU	<1	<1	< 1	<1	1	1
7	TDS	mg /l	412	464	633	559	500	500
8	Total Hardness	mg/l	138.5	118.9	221.6	172.9	200	200
9	Calcium as Ca	mg/l	32.3	27.4	41.7	37.2	75	75
10	Magnesium as Mg	mg/l	14.1	12.3	28.6	19.5	30	30
11	Total Alkalinity	mg/l	147	112	214	153	200	200
12	Chloride as Cl⁻	mg/l	101	179	183	198	250	250
13	Sulphate as SO₄⁻	mg/l	44.4	33.6	55	38.5	200	200
14	Iron as Fe	mg/l	BDL	BDL	BDL	BDL	0.3	0.3
15	Free Residual Cl	mg/l	BDL	BDL	BDL	BDL	0.2	0.2
16	Fluoride as F	mg/l	0.17	0.24	0.29	0.31	1.0	1.0
17	Nitrates as NO₃	mg/l	5.6	8.3	14.3	15.5	45	45
18	Copper as Cu	mg/l	BDL	BDL	BDL	BDL	0.05	0.05
19	Manganese as Mn	mg/l	BDL	BDL	BDL	BDL	0.1	0.1
20	Mercury as Hg	mg/l	BDL	BDL	BDL	BDL	0.001	0.001
21	Cadmium as Cd	mg/l	BDL	BDL	BDL	BDL	0.003	0.003
22	Selenium as Se	mg/l	BDL	BDL	BDL	BDL	0.01	0.01
23	Aluminium as Al	mg/l	BDL	BDL	BDL	BDL	0.03	0.03
24	Lead as Pb	mg/l	BDL	BDL	BDL	BDL	0.01	0.01
25	Zinc as Zn	mg/l	BDL	BDL	BDL	BDL	5	5
26	Total Chromium	mg/l	BDL	BDL	BDL	BDL	0.05	0.05
27	Boron as B	mg/l	BDL	BDL	BDL	BDL	0.5	0.5
28	Mineral Oil	mg/l	BDL	BDL	BDL	BDL	0.5	0.5
29	Phenolic Compounds	mg/l	Absent	Absent	Absent	Absent	0.001	0.001
30	Anionic Detergents	mg/l	BDL	BDL	BDL	BDL	0.2	0.2
31	Cyanide as CN	mg/l	Absent	Absent	Absent	Absent	0.05	0.05
32	Total Coliform	MPN/ 100ml	< 2	< 2	< 2	< 2	Shall not be detectable in any100 ml	Shall not be detectable in any100 ml
33	E-Coli		< 2	< 2	< 2	< 2		
34	Barium as Ba	mg/l	BDL	BDL	BDL	BDL	0.7	0.7
35	Ammonia	mg/l	BDL	BDL	BDL	BDL	0.5	0.5
36	Sulphide as H₂S	mg/l	BDL	BDL	BDL	BDL	0.05	0.05
37	Molybdenum	mg/l	BDL	BDL	BDL	BDL	0.07	0.07
38	Total Arsenic	mg/l	BDL	BDL	BDL	BDL	0.01	0.01
39	Total Suspended Solids	mg/l	BDL	BDL	BDL	BDL		2

* 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

TABLE 3.11: SURFACE WATER SAMPLING RESULTS

Sl. No.	Parameter	Unit	RESULT		CPCB Designated Best Use
			SW1	SW2	
1	Color	Hazen	15	10	300
2	Odour	-	Agreeable	Agreeable	Not specified
3	Taste	-	Agreeable	Disagreeable	Not specified
4	pH@ 25°C	-	7.77	7.81	6.5 – 8.5
5	Electrical Conductivity @ 25^{0}C	µs/cm	1017	1509	
6	Turbidity	NTU	12.3	6.9	Not specified
7	Total Dissolved Solids	mg /l	488	890	1500
8	Total Hardness as CaCO$_3$	mg/l	246.8	395.3	Not specified
9	Calcium as Ca	mg/l	58.7	71.6	Not specified
10	Magnesium as Mg	mg/l	24.4	52.7	Not specified
11	Total Alkalinity as CaCO$_3$	mg/l	202	288	Not specified
12	Chloride as Cl$^-$	mg/l	51	221	600
13	Sulphate as SO$_4^-$	mg/l	37.5	79.2	400
14	Iron as Fe	mg/l	0.16	0.19	50
15	Free Residual Chlorine	mg/l	BDL(DL: 2.0)	BDL(DL: 2.0)	400
16	Fluoride as F	mg/l	0.37	0.41	1.5
17	Nitrates as NO$_3$	mg/l	17.1	28.3	50
18	Copper as Cu	mg/l	BDL (DL:0.2)	BDL (DL:0.2)	1.5
19	Manganese as Mn	mg/l	BDL (DL:0.05)	BDL (DL:0.05)	Not specified
20	Mercury as Hg	mg/l	(BDL (DL: 0.0005)	(BDL (DL: 0.0005)	Not specified
21	Cadmium as Cd	mg/l	BDL (DL:0.01)	BDL (DL:0.01)	0.01
22	Selenium as Se	mg/l	BDL (DL: 0.05)	BDL (DL: 0.05)	Not specified
23	Aluminium as Al	mg/l	BDL (DL: 0.03)	BDL (DL: 0.03)	Not specified
24	Lead as Pb	mg/l	BDL (DL:0.01)	BDL (DL:0.01)	0.1
25	Zinc as Zn	mg/l	BDL (DL:0.02)	BDL (DL:0.02)	15
26	Total Chromium	mg/l	BDL (DL: 0.05)	BDL (DL: 0.05)	0.05
27	Boron as B	mg/l	BDL (DL:0.1)	BDL (DL:0.1)	Not specified
28	Mineral Oil	mg/l	BDL (DL:1.0)	BDL (DL:1.0)	Not specified
29	Phenolic Compounds as C$_6$H$_5$OH	mg/l	Absent	Absent	0.005
30	Anionic Detergents as MBAS	mg/l	BDL (DL:0.1)	BDL (DL:0.1)	Not specified
31	Cyanide as CN	mg/l	Absent	Absent	0.05
32	Biological Oxygen Demand, 3 days @ 27°C	mg/l	7.1	8.7	
33	Chemical Oxygen Demand	mg/l	29.5	36	
34	Dissolved oxygen	mg/l	5.6	4.6	
35	Total Coliform	Per 100ml	Present	< 2	5000
36	E-Coli		Present	< 2	Not specified
37	Barium as Ba	mg/l	BDL (DL:0.5)	BDL (DL:0.5)	300
38	Ammonia (as Total Ammonia-N)	mg/l	BDL (DL:0.1)	BDL (DL:0.1)	Not specified
39	Sulphide as H$_2$S	mg/l	BDL (DL:0.05)	BDL (DL:0.05)	Not specified
40	Molybdenum as Mo	mg/l	BDL (DL:0.5)	BDL (DL:0.5)	Not specified
41	Total Arsenic as As	mg/l	BDL (DL:0.01)	BDL (DL:0.01)	0.2
42	Total Suspended Solids	mg/l	3.1	13.1	

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

3.2.4   Interpretation & Conclusion

Surface Water

Ph:

The pH varied from 7.77 to 7.81 while turbidity found within the standards (Optimal pH range for sustainable aquatic life is 6.5 to 8.5 pH).

Total Dissolved Solids:

Total Dissolved Solids varied from 488 to 890 mg/l, the TDS mainly composed of carbonates, bicarbonates, Chlorides, phospates and nitrates of calcium, magnesium, sodium and other organic matter.

Other parameters:

Chloride varied between 51.0 mg/l and 221 mg/l. Nitrates varied from 17.1 to 28.3 mg/l, while sulphates varied from 37.5 to 79.2 mg/l.

Ground Water

The pH of the water samples collected ranged from 7.1 to 8.05 and within the acceptable limit of 6.5 to 8.5. pH, Sulphates and Chlorides of water samples from all the sources are within the limits as per the Standard. On Turbidity, the water samples meet the requirement. The Total Dissolved Solids were found in the range of 412- 663 mg/l in all samples. The Total hardness varied between 118.9- 221.6 mg/l.

On Microbiological parameters, the water samples from all the locations meet the requirement. The parameters thus analysed were compared with IS 10500:2012 and are well within the prescribed limits.

3.2.5   Hydrology and Hydrogeological studies

The district is underlain by hard rock formation fissured and fractured crystalline rocks constitute the important aquifer systems in the district. Geophysical prospecting was carried out in that area by SSRMP-80 Instrument by qualified Geo physicist with the help of IGIS software and it was inferred that the low resistance encountered at the depth between 50 - 55m. The maximum depth proposed out of proposed projects is 38 m bgl. Hence there is no possibilities of water table intersection during the entire mine life period besides it is also inferred topographically that there are no major water bodies intersecting the project area. There is no necessity of stream, channel diversion due to these proposed projects.

During the rainy season there is a possibility of collection of seepage water from the subsurface levels this is due to the high intensity of fracture and weathered portion upto a depth of 5m thus the collected seepage water will be stored in the mine sump pits and will be used for dust suppression and greenbelt development and during the end of the life of the mine this collected water will act as a temporary reservoir.

FIGURE 3.5: WATER SAMPLE COLLECTIONS PHOTOGRAPHS

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FIGURE 3.6: DRAINAGE MAP AROUND 10 KM RADIUS FROM PROJECT SITE
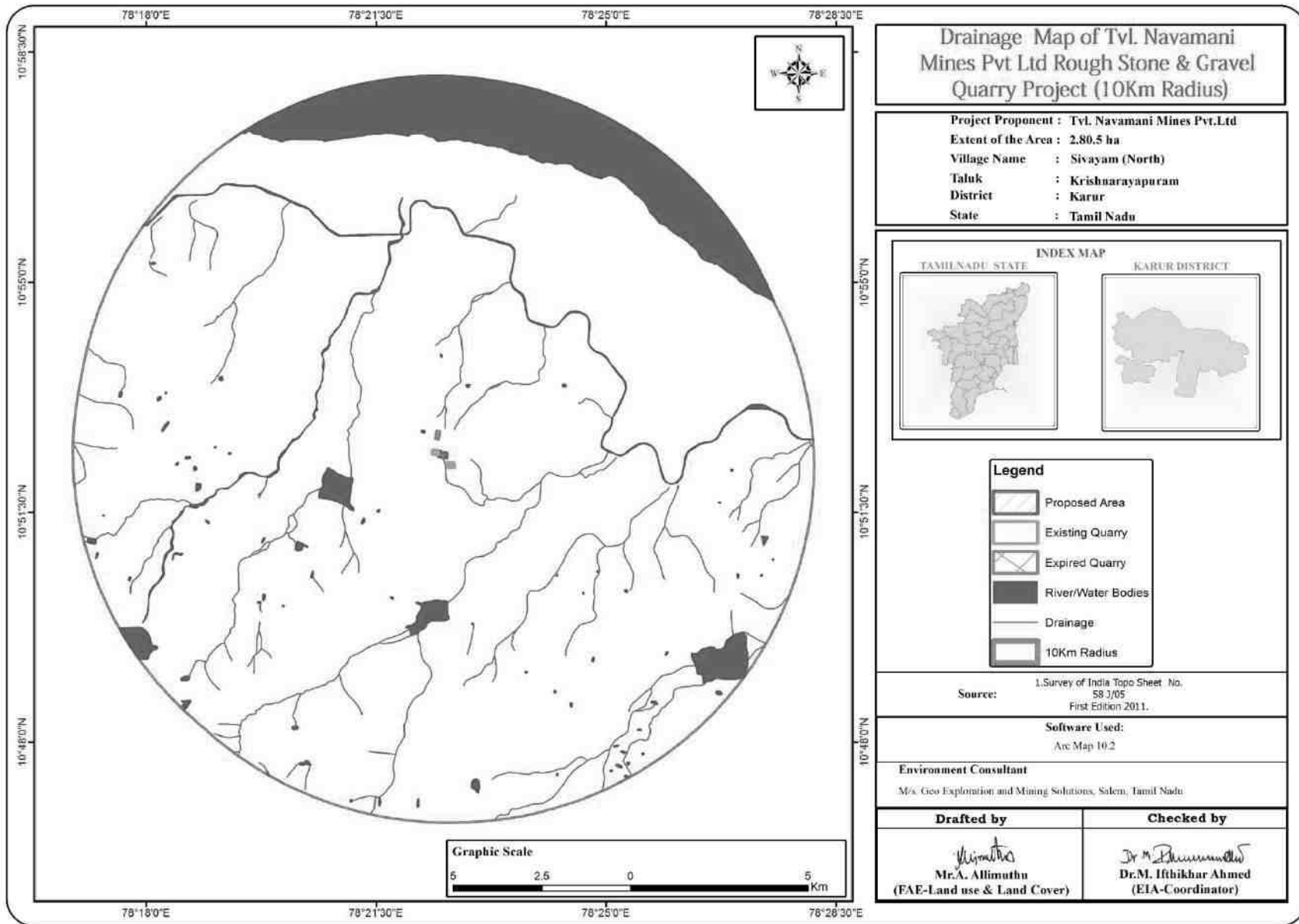
FIGURE 3.7: GROUND WATER PROSPECT MAP
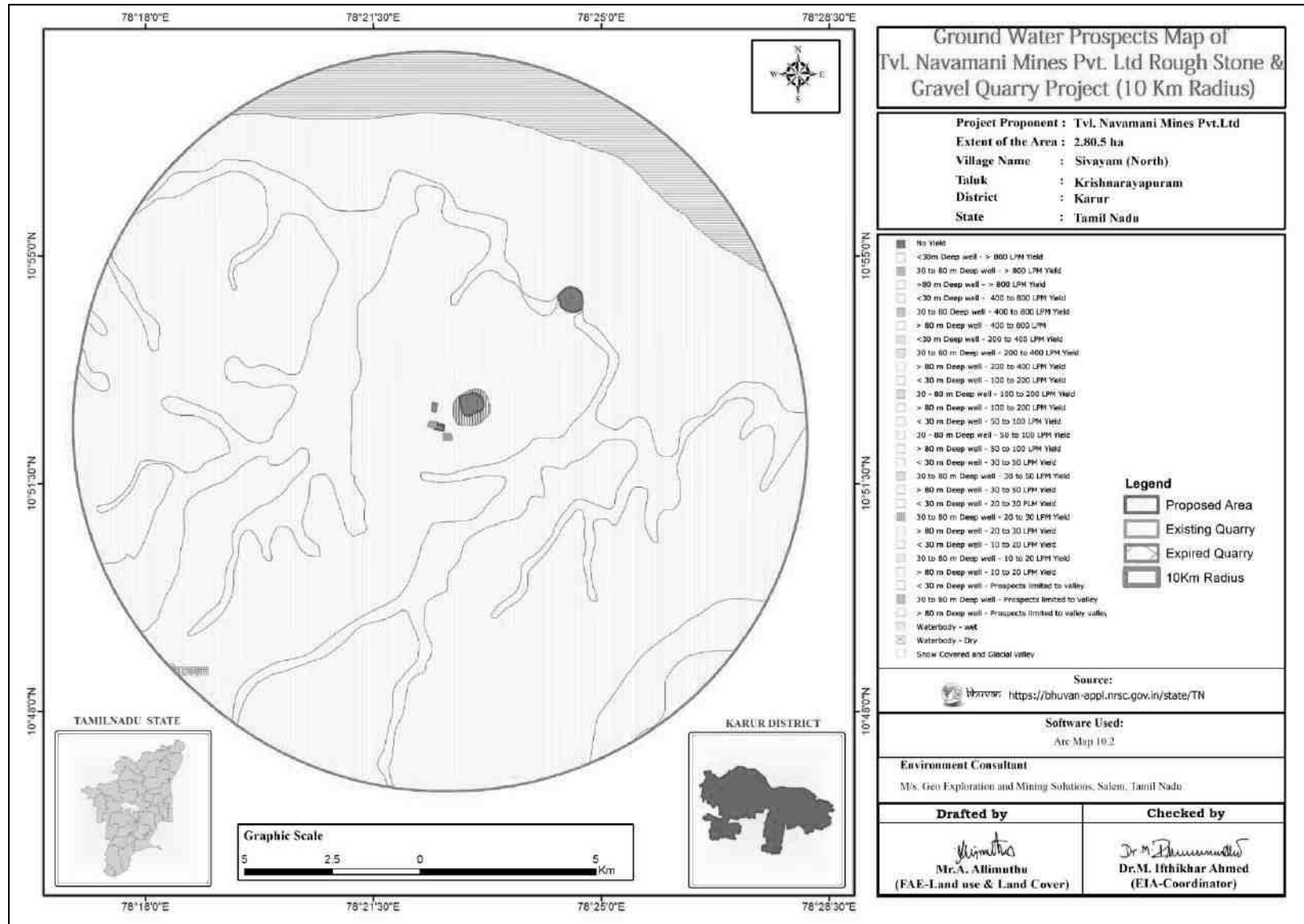
3.3   AIR ENVIRONMENT

The existing ambient air quality of the area is important for evaluating the impact of mining activities on the ambient air quality.

The baseline studies on air environment include identification of specific air pollution parameters and their existing levels in ambient air. The ambient air quality with respect to the study zone of 10 km radius around the cluster forms the baseline information. The sources of air pollution in the region are mostly due to vehicular traffic, dust arising from unpaved village road and domestic & agricultural activities. The prime objective of the baseline air quality study was to establish the existing ambient air quality of the study area. These will also be useful for assessing the conformity to standards of the ambient air quality during the operation of proposed projects in cluster.

This section describes the identification of sampling locations, methodology adopted during the monitoring period and sampling frequency.

3.3.1   Meteorology & Climate

Meteorology is the key to understand the Air quality. The essential relationship between meteorological condition and atmospheric dispersion involves the wind in the broadest sense. Wind fluctuations over a very wide range of time, accomplish dispersion and strongly influence other processes associated with them.

A temporary meteorological station was installed at project site by covering cluster quarries. The station was installed at a height of 3 m above the ground level in such a way that there are no obstructions facilitating flow of wind, wind speed, wind direction, humidity and temperature are recorded on hourly basis.

Climate –

➢ The district lies on 127m above sea level and The Karur lies on 127m above sea level The prevailing climate in Karur is known as a local steppe climate. During the year, there is little rainfall in Karur. According to Köppen and Geiger, this climate is classified as BSh.
➢ The average annual temperature is 28.7 °C | 83.7 °F.
➢ The annual rainfall here is around 595 mm | 23.4 inch per year.
➢ The driest month is March, with 8 mm | the greatest amount of precipitation occurs in October, with an average of 166 mm | 6.5 inch.
➢ The warmest month of the year is May, with an average temperature of 31.5°C | 88.7 °F.
    The lowest average temperatures in the year occur in December, when it is around 25.6°C | 78.1 °F.
➢ The difference in precipitation between the driest month and the wettest month is 158 mm | 6 inch. The variation in temperatures throughout the year is 5.9 °C | 42.6 °F.

Source: https://en.climate-data.org/asia/india/tamil-nadu/karur-24030

Rainfall –

TABLE 3.12: RAINFALL DATA

Actual Rainfall in mm						Normal Rainfall in mm
2013	2014	2015	2016	2017	2018	
460.8	511.5	784.1	328.8	715.3	468.4	655.0

Source: https://www.twadboard.tn.gov.in/content/karur

TABLE 3.13: METEOROLOGICAL DATA RECORDED AT SITE

S.No	Parameters		March 2021	April 2021	May 2021
1	Temperature (^{0}C)	Max	30.5	29.1	28.1
		Min	24.3	24.5	24.1
		Avg.	27.4	26.8	26.1
2	Relative Humidity (%)	Avg.	78.45	80.1	64.29
3	Wind Speed (m/s)	Max	4.584	4.931	6.111
		Min	1.086	1.389	2.57
		Avg.	2.835	3.16	4.34
4	Cloud Cover (OKTAS)		0-8	0-8	0-8
5	Wind direction		SSE,ESE	NE,SW	NE,ENE

Source: On-site monitoring/sampling by KGS Laboratories in association with GEMS

Correlation between Secondary and Primary Data

The meteorological data collected at the site is almost similar to that of secondary data collected from IMD Trichy. A comparison of site data generated during the three months with that of IMD, Trichy reveals the following:

- The average maximum and minimum temperatures of IMD, Trichy showed a higher in respect of on-site data i.e. in Sivayam (North) village.
- The relative humidity levels were lesser at site as compared to IMD, Trichy.
- The wind speed and direction at site shows similar trend that of IMD, Trichy

Wind rose diagram of the study site is depicted in Figure. 3.15. Predominant downwind direction of the area during study season is North - East to South West.

FIGURE 3.8: WIND ROSE DIAGRAM
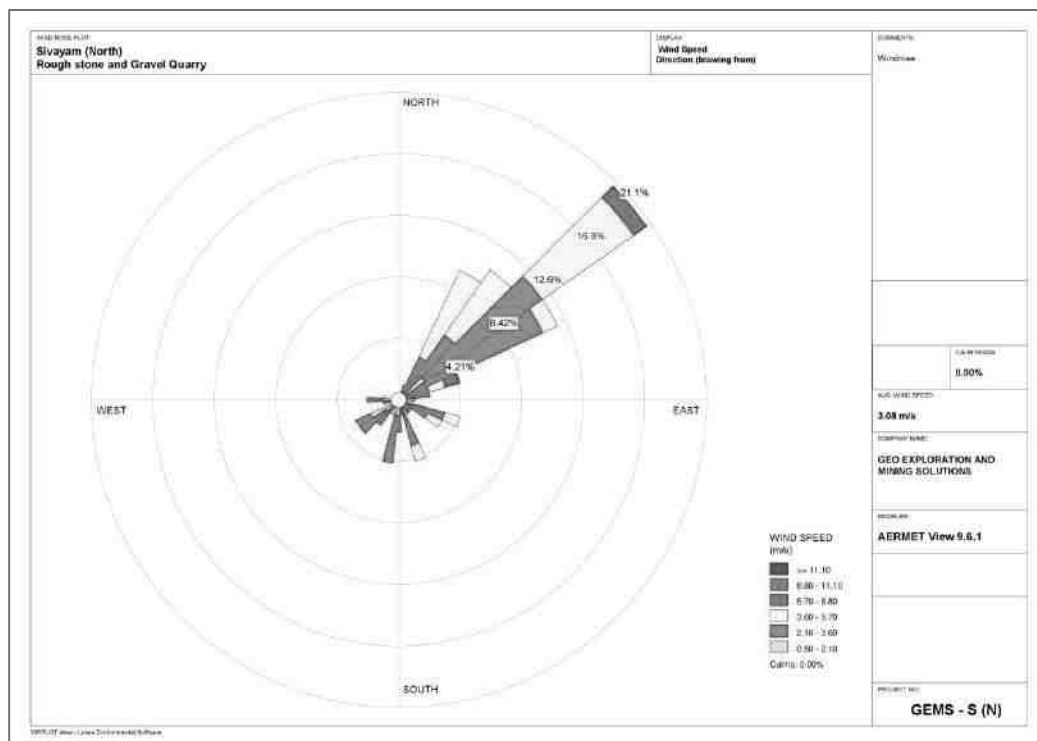
Source: Wind Rose plot view, Lake Environmental Software

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In the abstract of collected data wind rose were drawn on presented in figure No.3.15 during the monitoring period in the study area

- Predominant winds were from NE- SW
- Wind velocity readings were recorded between 0.50 to 11.10 m/s
- Temperature readings ranging from 24.3to 30.5 °C
- Relative humidity ranging from 64.29 to 80.1 %

3.3.2 Methodology and Objective

The prime objective of the ambient air quality study is to assess the existing air quality of study area and its conformity to NAAQS. The observed sources of air pollution in the study area are industrial, traffic and domestic activities. The baseline status of the ambient air quality has been established through a scientifically designed ambient air quality monitoring network considering the followings:

- Meteorological condition on synoptic scale;
- Topography of the study area;
- Representatives of regional background air quality for obtaining baseline status;
- Location of residential areas representing different activities;
- Accessibility and power availability; etc.,

3.3.3 Sampling and Analytical Techniques

TABLE 3.14: METHODOLOGY AND INSTRUMENT USED FOR AIR QUALITY MONITORING

Parameter	Method	Instrument
$PM_{2.5}$	Gravimetric Method Beta attenuation Method	Fine Particulate Sampler Make – Thermo Environmental Instruments – TEI 121
PM_{10}	Gravimetric Method Beta attenuation Method	Respirable Dust Sampler Make –Thermo Environmental Instruments – TEI 108
SO_2	IS-5182 Part II (Improved West & Gaeke method)	Respirable Dust Sampler with gaseous attachment
NO_x	IS-5182 Part II (Jacob & Hochheiser modified method)	Respirable Dust Sampler with gaseous attachment
Free Silica	NIOSH – 7601	Visible Spectrophotometry

Source: Sampling Methodology followed by KGS Laboratories & CPCB Notification

TABLE 3.15: NATIONAL AMBIENT AIR QUALITY STANDARDS

Sl. No.	Pollutant	Time Weighted Average	Concentration in ambient air	
			Industrial, Residential, Rural & other areas	Ecologically Sensitive area (Notified by Central Govt.)
1	Sulphur Dioxide ($\mu g/m^3$)	Annual Avg.* 24 hours**	50.0 80.0	20.0 80.0
2	Nitrogen Dioxide ($\mu g/m^3$)	Annual Avg. 24 hours	40.0 80.0	30.0 80.0
3	Particulate matter (size less than 10μm) PM_{10} ($\mu g/m^3$)	Annual Avg. 24 hours	60.0 100.0	60.0 100.0
4	Particulate matter (size less than 2.5 μm $PM_{2.5}$ ($\mu g/m^3$)	Annual Avg. 24 hours	40.0 60.0	40.0 60.0

Source: NAAQS CPCB Notification No. B-29016/20/90/PCI-I Dated: 18th Nov 2009
*Annual Arithmetic mean of minimum 104 measurements in a year taken twice a Week 24 hourly at uniform interval
** 24 hourly / 8 hourly or 1 hourly monitored values as applicable shall be complied with 98 % of the time in a year. However, 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.

3.3.4   Frequency & Parameters for Sampling

Ambient air quality monitoring has been carried out with a frequency of two samples per week at Eight (8) locations, adopting a continuous 24 hourly (3 shift of 8-hour) schedule for the period March to May 2021. The baseline data of ambient air has been generated for PM_{10}, $PM_{2.5}$, Sulphur Dioxide (SO_2) & Nitrogen Dioxide (NO_2) Monitoring has been carried out as per the CPCB, MoEF guidelines and notifications.

It was ensured that the equipment was placed preferably at a height of at least $3 \pm 0.5m$ above the ground level at each monitoring station, for negating the effects of wind-blown ground dust. The equipment was placed at open space free from trees and vegetation which otherwise act as a sink of pollutants resulting in lower levels in monitoring results.

3.3.5   Ambient Air Quality Monitoring Stations

Eight (8) monitoring stations were set up in the study area as depicted in Figure 3.6.1 for assessment of the existing ambient air quality. Details of the sampling locations are as per given below.

TABLE 3.16: AMBIENT AIR QUALITY (AAQ) MONITORING LOCATIONS

S. No	Location Code	Monitoring Locations	Distance & Direction	Coordinates
1	AAQ-1	Project Area	West Corner	10°52'23.66"N 78°22'27.41"E
2	AAQ-2	Project Area	North East Corner	10°52'23.51"N 78°22'33.95"E
3	AAQ-3	Near Crusher	600m North from the project site	10°52'43.36"N 78°22'21.60"E
4	AAQ-4	Kuzanthai Patti	850m South West	10°52'17.63"N 78°21'57.95"E
5	AAQ-5	Kuzanthai Patti	1.0 Km South West	10°52'3.34"N 78°21'52.73"E
6	AAQ-6	Kodangipatti	1.5 Km South	10°51'36.80"N 78°22'04.92"E
7	AAQ-7	Iyermali	1.5 Km North East	10°52'36.04"N 78°23'18.11"E
8	AAQ-8	Irumboothipatti	1. 5Km South East	10°51'33.69"N 78°23'02.38"E

Source: On-site monitoring/sampling by KGS Laboratories in association with GEMS

FIGURE 3.9: AMBIENT AIR QUALITY MONITORING PHOTOGRAPHS

GEO EXPLORATION AND MINING SOLUTIONS

FIGURE 3.10: AMBIENT AIR QUALITY LOCATIONS AROUND 10 KM RADIUS

Ambient Air Quality Monitoring Station Map of Tvl. Navamani Mines Pvt Ltd Rough Stone & Gravel Quarry Project (5 Km Radius)

Project Proponent : Tvl. Navamani Mines Pvt.Ltd
Extent of the Area : 2,80.5 ha
Village Name : Sivayam (North)
Taluk : Krishnarayapuram
District : Karur
State : Tamil Nadu

S. No	Location Code	Monitoring Locations	Distance & Direction	Coordinates
1	AAQ-1	Project Area	West Corner	10°52'23.66"N 78°22'27.41"E
2	AAQ-2	Project Area	Northeast Corner	10°52'23.51"N 78°22'33.95"E
3	AAQ-3	Near Crusher	600m from the Project Site NW	10°52'43.36"N 78°22'21.60"E
4	AAQ-4	Kuzanthai Patti	850m Southwest	10°52'17.63"N 78°21'57.95"E
5	AAQ-5	Kuzanthai Patti	1.0Km Southwest	10°52'3.34"N 78°21'52.73"E
6	AAQ-6	Kodangipatti	1.5Km SouthWest	10°51'36.80"N 78°22'04.92"E
7	AAQ-7	Iyermali	1.5Km Northeast	10°52'36.04"N 78°23'18.11"E
8	AAQ-8	Irumboothipatti	1.5Km Southeast	10°51'33.69"N 78°23'02.38"E

Source:
1.Survey of India Topo Sheet No. 58 J/05 First Edition 2011.

Software Used:
2. Arc Map 10.2, 2.Global Mapper 15

Environment Consultant
M/s. Geo Exploration and Mining Solutions, Salem, Tamil Nadu

Drafted by	Checked By
Mr.A. Allimuthu (FAE-Land use & Land Cover)	Dr.M. Ifthikhar Ahmed (EIA-Coordinator)

Legend
- Ambient Air Quality Monitoring Station
- Proposed Area
- Existing Quarry
- Expired Quarry
- 5Km Radius

Graphic Scale
2.5   1.25   0   2.5 Km

TABLE 3.17 A: AAQ1- CORE ZONE – WEST Corner

Monitoring	Particulates, µg/m³		Gaseous Pollutants, µg/m³					Other Pollutants (Particulate Phase) , µg/m³				
Date/ Parameters	PM$_{10}$, µg/m³	PM$_{2.5}$, µg/m³	SO$_2$, µg/m³	NO$_2$, µg/m³	NH$_3$ µg/m³	O$_3$ (8-hly Avg.) µg/m³	CO (8-hly Avg.) mg/m³	Pb, µg/m³	As, ng/m³	Ni, ng/m³	C$_6$H$_6$, µg/m³	BaP, ng/m³
NAAQ Norms*	100 (24 hrs.)	60 (24 hrs.)	80 (24 hrs.)	80 (24 hrs.)	400 (24 hrs.)	100 (8 hrs.)	2.0 (8hrs.)	1.0 (24 hrs.)	6.0 (annual)	20 (annual)	5.0 (annual)	1.0 (annual)
02.03.2021	46.9	22.3	8.2	24.3	12.3	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
03.03.2021	46.8	22.9	8.4	24.9	14.3	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
09.03.2021	47.3	22.7	7.6	24.7	14.3	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
10.03.2021	47.6	22.6	7.2	25.3	14.8	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
16.03.2021	47.3	23.4	7.2	25.4	13.5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
17.03.2021	45.8	23.8	7.9	25.1	15.6	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
23.03.2021	48.6	21.5	7.3	25.7	15.7	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
24.03.2021	48.3	24.6	6.8	25.3	12.2	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
30.03 2021	46.9	24.6	6.1	25.6	11.3	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
01.04.2021	46.7	24.1	6.7	25.1	12.1	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
06.04.2021	45.3	23.2	6.3	24.3	12.2	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
07.04.2021	45.9	23.9	6.8	24.6	12	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
13.04.2021	47.2	22.1	7.2	24.7	11.3	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
14.04.2021	47.8	22.7	7.5	24.3	11.7	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
20.04.2021	46.5	23.5	7.5	24.8	8.9	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
21.04.2021	46.2	23.4	6.9	23.2	8.4	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
27.04.2021	47.3	23.4	6.4	23.8	9.6	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
28.04.2021	48.2	21.6	6.6	25.3	9.8	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
04.02.2021	48.8	24.6	6.7	24.3	9.3	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
05.05.2021	47.3	24.3	6.7	24.3	9.4	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
11.05.2021	48.6	22.3	6	26.1	9.2	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
12.05.2021	48.2	21.3	5.9	21.2	9.5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
18.05.2021	47.2	21.5	5.8	22.3	9.3	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
19.05.2021	46.3	22.4	6.7	21.8	9.1	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
25.05.2021	44.3	22.6	6.5	27.3	9.3	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
26.05.2021	47.3	21.4	6.3	26.5	9.8	<5	<1.0	<0.01	<5	<3	<1.0	<3.0

GEO EXPLORATION AND MINING SOLUTIONS

TABLE 3.17 B: AAQ2 - CORE ZONE – North East Corner

Monitoring	Particulates, µg/m³		Gaseous Pollutants, µg/m³					Other Pollutants (Particulate Phase) , µg/m³				
Date/ Parameters	$PM_{10,}$ µg/m³	$PM_{2.5,}$ µg/m³	$SO_2,$ µg/m³	$NO_2,$ µg/m³	NH_3 µg/m³	O_3 (8-hly Avg.) µg/m³	CO (8-hly Avg.) mg/m³	Pb, µg/m³	As, ng/m³	Ni, ng/m³	$C_6H_6,$ µg/m³	BaP, ng/m³
NAAQ Norms*	100 (24 hrs.)	60 (24 hrs.)	80 (24 hrs.)	80 (24 hrs.)	400 (24 hrs.)	100 (8 hrs.)	2.0 (8hrs.)	1.0 (24 hrs.)	6.0 (annual)	20 (annual)	5.0 (annual)	1.0 (annual)
02.03.2021	44.6	20.5	8.3	26.3	8.9	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
03.03.2021	44.9	20.9	8.1	26.7	8.2	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
09.03.2021	45.8	21.5	7.6	25.3	8.4	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
10.03.2021	45.7	21.7	7.9	25.9	8	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
16.03.2021	46.8	22.3	7.6	25.1	7.3	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
17.03.2021	46.2	21.6	7.1	25.4	7.6	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
23.03.2021	47.2	21.8	7.3	23.4	7.8	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
24.03.2021	47.9	19.2	7.6	24.8	7.7	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
30.03 2021	47.8	18.3	7.8	21.6	7.3	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
01.04.2021	46.3	21.6	6.8	24.9	7.8	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
06.04.2021	47.5	21.8	6.4	23.2	8.3	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
07.04.2021	45.6	23.4	6.8	24.5	8.1	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
13.04.2021	44.3	22.8	6.7	21.7	8.3	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
14.04.2021	45.8	21.6	6.1	20.7	8.8	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
20.04.2021	47.6	24.3	6.8	21.8	7.3	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
21.04.2021	47.1	22.7	5.7	22	8.6	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
27.04.2021	45.2	22.2	5.8	23.8	7.2	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
28.04.2021	44.3	22.9	6.1	24.2	8.9	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
04.02.2021	41.5	22.4	6.7	25.3	9.4	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
05.05.2021	45.6	23.3	7.3	25.7	9.7	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
11.05.2021	41.5	23.5	7.6	26.3	8.3	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
12.05.2021	46.2	21.4	7.9	21.7	8.2	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
18.05.2021	47.3	18.3	5.6	22.3	7.3	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
19.05.2021	47.2	19.5	5.9	24.3	7.9	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
25.05.2021	45.6	21.7	6.3	24.9	7.5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
26.05.2021	46.8	21.5	6.7	25.0	7.1	<5	<1.0	<0.01	<5	<3	<1.0	<3.0

GEO EXPLORATION AND MINING SOLUTIONS

TABLE 3.17 C: AAQ3 – NEAR CRUSHER AREA (BUFFER ZONE)

Monitoring	Particulates, µg/m³		Gaseous Pollutants, µg/m³					Other Pollutants (Particulate Phase) , µg/m³				
Date/ Parameters	PM$_{10,}$ µg/m³	PM$_{2.5,}$ µg/m³	SO$_2$, µg/m³	NO$_2$, µg/m³	NH$_3$ µg/m³	O$_3$ (8-hly Avg.) µg/m³	CO (8-hly Avg.) mg/m³	Pb, µg/m³	As, ng/m³	Ni, ng/m³	C$_6$H$_6$, µg/m³	BaP, ng/m³
NAAQ Norms*	100 (24 hrs.)	60 (24 hrs.)	80 (24 hrs.)	80 (24 hrs.)	400 (24 hrs.)	100 (8 hrs.)	2.0 (8hrs.)	1.0 (24 hrs.)	6.0 (annual)	20 (annual)	5.0 (annual)	1.0 (annual)
02.03.2021	48.3	21.3	6.3	23.5	10.3	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
03.03.2021	47.3	21.7	6.4	23.4	10.1	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
09.03.2021	45.6	21.9	6.8	23.4	9.3	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
10.03.2021	45.2	24.3	6.9	21.2	10	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
16.03.2021	44.2	22.5	6.1	21.6	10.3	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
17.03.2021	44.1	22.7	6.2	20.	10.6	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
23.03.2021	42.3	21.3	6.2	21.5	9.7	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
24.03.2021	42.3	21.8	6.7	21.7	9.5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
30.03 2021	41.5	22.4	6.8	21.6	9.2	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
01.04.2021	41.8	22.1	7.6	20.3	9.6	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
06.04.2021	41.3	22.3	7.3	21.6	9.3	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
07.04.2021	44.3	23.4	7.6	21.3	9.1	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
13.04.2021	42.5	23.5	7.5	22.3	9.3	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
14.04.2021	42.7	21.6	7.2	21.7	9.7	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
20.04.2021	45.6	24.5	7.3	22.3	9.2	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
21.04.2021	45.9	21.6	7.2	24.3	9.9	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
27.04.2021	46.2	21.8	7.5	21.3	9.3	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
28.04.2021	46.7	20.3	7.3	22.7	9.2	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
04.02.2021	46.2	20.4	6.2	23.6	9	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
05.05.2021	45.8	22	6.5	24.2	8.7	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
11.05.2021	45.7	21.3	6.2	21.2	8.2	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
12.05.2021	45.3	24.3	6.8	21	7.6	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
18.05.2021	46.2	23.5	5.3	18.7	8.9	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
19.05.2021	46.7	22.3	5.1	18.9	9.8	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
25.05.2021	45.2	21.5	5.4	19.2	8.2	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
26.05.2021	45.5	20.5	5.7	19.7	8.3	<5	<1.0	<0.01	<5	<3	<1.0	<3.0

TABLE 3.17 D: AAQ4 – KUZHANTHAIPATTI VILLAGE (BUFFER ZONE)

Monitoring	Particulates, µg/m³		Gaseous Pollutants, µg/m³					Other Pollutants (Particulate Phase) , µg/m³				
Date/ Parameters	PM$_{10}$, µg/m³	PM$_{2.5}$, µg/m³	SO$_2$, µg/m³	NO$_2$, µg/m³	NH$_3$ µg/m³	O$_3$ (8-hly Avg.) µg/m³	CO (8-hly Avg.) mg/m³	Pb, µg/m³	As, ng/m³	Ni, ng/m³	C$_6$H$_6$, µg/m³	BaP, ng/m³
NAAQ Norms*	100 (24 hrs.)	60 (24 hrs.)	80 (24 hrs.)	80 (24 hrs.)	400 (24 hrs.)	100 (8 hrs.)	2.0 (8hrs.)	1.0 (24 hrs.)	6.0 (annual)	20 (annual)	5.0 (annual)	1.0 (annual)
02.03.2021	42.3	18.3	7.3	23.1	9.3	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
03.03.2021	42.6	17.6	7.6	22.5	9.6	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
09.03.2021	43.5	18.3	7.5	24.5	9.7	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
10.03.2021	41.3	19.5	7.7	25.6	8.3	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
16.03.2021	42.5	18.6	7.9	21.2	8.6	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
17.03.2021	42.5	19.3	7.8	20.5	8.1	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
23.03.2021	42.9	18.6	7.2	23.3	8.5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
24.03.2021	43.5	18	7.6	21.5	9.3	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
30.03 2021	42.5	19.6	8.2	22.1	9.2	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
01.04.2021	43.7	18.6	6.3	19.3	9.2	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
06.04.2021	44.3	18.3	6.7	19.4	9.4	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
07.04.2021	42.5	19.6	6.8	18.3	8.6	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
13.04.2021	43.2	18.3	6.9	18.3	8.7	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
14.04.2021	42.6	18.6	6.4	18.7	8.6	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
20.04.2021	43.2	18.3	5.3	18.3	8.2	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
21.04.2021	44.8	19.3	5.4	19.3	8.4	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
27.04.2021	45.6	19.3	5.6	19.5	8.3	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
28.04.2021	43.5	18.2	5.2	19.6	7.3	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
04.02.2021	45.6	17.2	5.7	19.7	7.9	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
05.05.2021	45.7	18.3	6.3	8.9	8.3	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
11.05.2021	44.3	18.3	6.4	20.2	8.1	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
12.05.2021	41.2	19.3	6.2	20.3	8.6	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
18.05.2021	42.4	18.3	8.3	21.3	8.7	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
19.05.2021	43.2	17.6	8.2	21.5	8.8	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
25.05.2021	44.3	18.2	8.4	22.3	8.2	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
26.05.2021	41.6	19.5	8.6	21.5	9.1	<5	<1.0	<0.01	<5	<3	<1.0	<3.0

GEO EXPLORATION AND MINING SOLUTIONS

TABLE 3.17 E: AAQ5 - KUZHANTHAIPATTI VILLAGE (BUFFER ZONE)

Monitoring	Particulates, µg/m³		Gaseous Pollutants, µg/m³					Other Pollutants (Particulate Phase) , µg/m³				
Date/ Parameters	PM_{10}, µg/m³	$PM_{2.5}$, µg/m³	SO_2, µg/m³	NO_2, µg/m³	NH_3 µg/m³	O_3 (8-hly Avg.) µg/m³	CO (8-hly Avg.) mg/m³	Pb, µg/m³	As, ng/m³	Ni, ng/m³	C_6H_6, µg/m³	BaP, ng/m³
NAAQ Norms*	100 (24 hrs.)	60 (24 hrs.)	80 (24 hrs.)	80 (24 hrs.)	400 (24 hrs.)	100 (8 hrs.)	2.0 (8hrs.)	1.0 (24 hrs.)	6.0 (annual)	20 (annual)	5.0 (annual)	1.0 (annual)
02.03.2021	38.9	21.4	5.8	20.8	9.5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
03.03.2021	40.1	23.6	6.3	22.3	9.6	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
09.03.2021	40.9	24.0	7.1	24.9	9.8	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
10.03.2021	38.6	20.8	5.4	23.5	9.2	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
16.03.2021	39.3	22.2	5.7	21.4	9.6	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
17.03.2021	41.4	20.5	8.0	20.9	9.5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
23.03.2021	42.6	21.9	7.4	24.5	9.5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
24.03.2021	38.5	22.3	6.9	26.0	9.2	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
30.03 2021	39.4	23.7	5.6	21.1	10.2	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
01.04.2021	41.1	24.1	5.1	23.5	10.5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
06.04.2021	40.5	22.6	6.3	25.5	10.6	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
07.04.2021	38.6	20.8	7.2	24.6	9.7	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
13.04.2021	42.4	21.4	6.1	22.3	8.3	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
14.04.2021	39.8	22.7	6.5	21.8	8.6	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
20.04.2021	39.0	22.9	7.5	24.5	8.4	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
21.04.2021	41.7	24.4	6.5	25.7	8.3	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
27.04.2021	42.9	23.8	7.8	24.8	8.2	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
28.04.2021	43.0	21.0	5.9	24.0	8.9	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
04.02.2021	40.2	20.7	6.9	25.7	9.2	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
05.05.2021	38.7	23.3	6.4	21.3	9.7	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
11.05.2021	39.4	22.7	5.7	23.1	9.6	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
12.05.2021	42.8	20.8	8.1	26.2	9.8	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
18.05.2021	39.4	21.5	5.5	25.8	7.3	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
19.05.2021	38.3	22.9	6.4	20.7	8.6	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
25.05.2021	41.1	23.8	7.1	23.4	8.3	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
26.05.2021	40.2	24.1	6.5	24.6	8.3	<5	<1.0	<0.01	<5	<3	<1.0	<3.0

TABLE 3.17 F: AAQ6 - KODANGIPATTI VILLAGE (BUFFER ZONE)

Monitoring	Particulates, $\mu g/m^3$		Gaseous Pollutants, $\mu g/m^3$					Other Pollutants (Particulate Phase) , $\mu g/m^3$				
Date/ Parameters	PM_{10}, $\mu g/m^3$	$PM_{2.5}$, $\mu g/m^3$	SO_2, $\mu g/m^3$	NO_2, $\mu g/m^3$	NH_3 $\mu g/m^3$	O_3 (8-hly Avg.) $\mu g/m^3$	CO (8-hly Avg.) mg/m^3	Pb, $\mu g/m^3$	As, ng/m^3	Ni, ng/m^3	C_6H_6, $\mu g/m^3$	BaP, ng/m^3
NAAQ Norms*	100 (24 hrs.)	60 (24 hrs.)	80 (24 hrs.)	80 (24 hrs.)	400 (24 hrs.)	100 (8 hrs.)	2.0 (8hrs.)	1.0 (24 hrs.)	6.0 (annual)	20 (annual)	5.0 (annual)	1.0 (annual)
02.03.2021	41.4	23.8	6.4	22.6	7.3	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
03.03.2021	42.8	24.1	7.6	21.9	7.6	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
09.03.2021	38.4	22.0	5.9	23.8	7.6	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
10.03.2021	39.8	21.6	6.1	24.8	7.3	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
16.03.2021	43.0	20.8	7.5	21.5	7.6	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
17.03.2021	38.9	21.6	8.4	22.6	7	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
23.03.2021	42.6	22.2	5.6	23.3	7.6	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
24.03.2021	41.8	23.5	6.1	24.5	7.6	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
30.03 2021	39.5	20.1	7.2	21.6	7.2	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
01.04.2021	38.4	24.0	7.9	22.1	7.3	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
06.04.2021	40.7	21.8	5.4	20.7	8.3	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
07.04.2021	41.8	21.4	6.1	22.6	7.6	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
13.04.2021	37.4	23.6	6.6	22.3	7.2	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
14.04.2021	39.4	24.3	7.2	21.8	7.9	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
20.04.2021	40.6	20.7	7.7	22.7	8.3	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
21.04.2021	41.2	22.4	6.9	23.8	8.1	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
27.04.2021	42.8	22.6	5.7	25.4	8.6	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
28.04.2021	41.0	21.4	5.5	21.8	8.5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
04.02.2021	41.9	20.7	6.3	21.5	8.3	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
05.05.2021	41.5	21.6	7.2	20.7	8.4	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
11.05.2021	38.7	22.5	7.4	21.8	9	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
12.05.2021	39.6	23.7	6.8	22.6	9.3	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
18.05.2021	37.4	24.2	7.9	24.5	9.4	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
19.05.2021	41.5	21.6	8.4	25.6	9.6	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
25.05.2021	42.1	22.7	6.8	21.7	8.5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
26.05.2021	41.3	23.5	7.4	24.7	8.2	<5	<1.0	<0.01	<5	<3	<1.0	<3.0

TABLE 3.17 G AAQ7 - IYERMALAI VILLAGE (BUFFER ZONE)

Monitoring	Particulates, µg/m³		Gaseous Pollutants, µg/m³					Other Pollutants (Particulate Phase) , µg/m³				
Date/ Parameters	PM$_{10}$, µg/m³	PM$_{2.5}$, µg/m³	SO$_2$, µg/m³	NO$_2$, µg/m³	NH$_3$ µg/m³	O$_3$ (8-hly Avg.) µg/m³	CO (8-hly Avg.) mg/m³	Pb, µg/m³	As, ng/m³	Ni, ng/m³	C$_6$H$_6$, µg/m³	BaP, ng/m³
NAAQ Norms*	100 (24 hrs.)	60 (24 hrs.)	80 (24 hrs.)	80 (24 hrs.)	400 (24 hrs.)	100 (8 hrs.)	2.0 (8hrs.)	1.0 (24 hrs.)	6.0 (annual)	20 (annual)	5.0 (annual)	1.0 (annual)
02.03.2021	41.5	21.5	6.4	26.1	11.3	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
03.03.2021	42.8	22.8	7.1	24.6	11.2	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
09.03.2021	39.1	20.7	5.9	25.7	11.6	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
10.03.2021	40.7	23.4	6.8	24.5	11.2	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
16.03.2021	43.5	24.0	7.1	20.9	10.2	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
17.03.2021	41.7	21.9	7.5	21.7	10.5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
23.03.2021	42.6	20.7	5.1	22.2	10.6	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
24.03.2021	38.7	21.8	6.3	23.8	10.3	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
30.03 2021	39.4	22.8	7.8	21.8	9.3	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
01.04.2021	41.5	22.9	7.4	21.4	9.6	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
06.04.2021	42.8	23.7	6.9	20.7	9.2	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
07.04.2021	38.7	20.7	5.1	20.9	9.4	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
13.04.2021	40.1	24.8	5.2	22.5	9.5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
14.04.2021	42.5	23.8	6.7	24.7	9.7	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
20.04.2021	41.9	21.7	7.6	23.5	9.3	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
21.04.2021	39.4	20.1	8.0	25.8	9.2	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
27.04.2021	38.7	21.8	4.9	20.7	8.3	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
28.04.2021	38.4	22.4	5.7	24.8	7.2	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
04.02.2021	40.2	21.7	6.1	26.4	9.3	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
05.05.2021	41.5	20.1	7.8	22.8	9.4	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
11.05.2021	42.5	22.8	6.4	21.4	9.5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
12.05.2021	41.8	23.1	7.9	23.5	9.3	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
18.05.2021	38.4	24.8	8.2	24.9	9.7	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
19.05.2021	39.7	21.7	7.1	22.1	9.5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
25.05.2021	40.5	22.8	6.8	25.8	9.1	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
26.05.2021	42.7	23.4	7.9	20.9	8.3	<5	<1.0	<0.01	<5	<3	<1.0	<3.0

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TABLE 3.17 H AAQ8 – IRUMBOOTHIPATTI (BUFFER ZONE)

Monitoring	Particulates, µg/m³		Gaseous Pollutants, µg/m³					Other Pollutants (Particulate Phase) , µg/m³				
Date/ Parameters	PM_{10}, µg/m³	$PM_{2.5}$, µg/m³	SO_2, µg/m³	NO_2, µg/m³	NH_3 µg/m³	O_3 (8-hly Avg.) µg/m³	CO (8-hly Avg.) mg/m³	Pb, µg/m³	As, ng/m³	Ni, ng/m³	C_6H_6, µg/m³	BaP, ng/m³
NAAQ Norms*	100 (24 hrs.)	60 (24 hrs.)	80 (24 hrs.)	80 (24 hrs.)	400 (24 hrs.)	100 (8 hrs.)	2.0 (8hrs.)	1.0 (24 hrs.)	6.0 (annual)	20 (annual)	5.0 (annual)	1.0 (annual)
02.03.2021	42.9	23.5	6.9	24.9	9.6	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
03.03.2021	41.5	22.7	7.1	25.7	9.3	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
09.03.2021	40.3	20.6	5.8	21.5	9.1	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
10.03.2021	42.2	24.8	8.2	22.4	9.2	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
16.03.2021	40.9	23.7	7.6	23.6	9.2	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
17.03.2021	43.5	22.9	5.1	24.7	8.3	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
23.03.2021	41.1	24.6	6.4	22.1	8.6	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
24.03.2021	40.9	25.1	7.9	23.7	7.5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
30.03 2021	42.8	23.7	6.3	24.8	8.2	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
01.04.2021	38.9	24.9	5.2	22.7	7.5	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
06.04.2021	38.1	25.6	6.4	21.8	7.9	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
07.04.2021	39.5	20.7	7.8	25.0	7.3	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
13.04.2021	38.4	21.6	8.0	23.8	7.9	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
14.04.2021	42.1	23.8	7.5	24.9	8.3	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
20.04.2021	40.1	21.9	5.9	22.7	8.6	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
21.04.2021	42.5	22.2	6.1	21.6	8.4	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
27.04.2021	40.6	20.7	7.2	20.8	8.3	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
28.04.2021	41.7	21.8	5.6	21.5	8.9	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
04.02.2021	38.9	24.8	7.8	22.7	8.6	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
05.05.2021	39.1	25.1	6.4	23.9	8.4	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
11.05.2021	40.7	20.7	5.3	24.8	8.9	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
12.05.2021	41.8	21.8	5.1	22.2	9.2	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
18.05.2021	40.9	20.4	6.8	22.7	9.2	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
19.05.2021	42.8	20.2	7.4	24.9	9.7	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
25.05.2021	41.2	21.3	6.7	20.4	9.9	<5	<1.0	<0.01	<5	<3	<1.0	<3.0
26.05.2021	38.3	25.1	5.2	21.6	9.7	<5	<1.0	<0.01	<5	<3	<1.0	<3.0

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TABLE 3.17 I: ABSTRACT OF AMBIENT AIR QUALITY DATA

Sl. No.	Parameter	Pollutant Concentration, µg/m³			
		PM_{10}	$PM_{2.5}$	SO_2	NO_2
1	No. of Observations	208	208	208	208
2	10th Percentile Value	38.76	18.60	5.50	20.30
3	20th Percentile Value	39.74	20.46	5.90	21.20
4	30th Percentile Value	40.90	20.99	6.30	21.60
5	40th Percentile Value	41.50	21.60	6.40	21.80
6	50th Percentile Value	42.15	21.80	6.80	22.50
7	60th Percentile Value	42.60	21.94	7.10	23.38
8	70th Percentile Value	43.20	22.80	7.30	23.89
9	80th Percentile Value	45.12	23.50	7.60	24.70
10	90th Percentile Value	46.05	24.10	7.90	25.15
11	95th Percentile Value	46.89	24.59	8.13	25.70
12	98th Percentile Value	47.41	24.97	8.35	26.05
13	Arithmetic Mean	**43.12**	**22.30**	**7.03**	**23.30**
14	Geometric Mean	43.03	22.23	6.97	23.22
15	Standard Deviation	2.90	1.92	0.93	1.96
16	Minimum	37.4	17.2	4.9	8.9
17	Maximum	48.8	25.6	8.6	26.7
18	NAAQ Norms*	**100**	**60**	**80**	**80**
19	% Values exceeding Norms*	**0**	**0**	**0**	**0**

Legend: $PM_{2.5}$-Particulate Matter size less than 2.5 µm; PM_{10}-Respirable Particulate Matter size less than 10 µm; SO_2-Sulphur dioxide; NO_2-Nitrogen Dioxide; CO-Carbon monoxide; O_3-Ozone; NH_3-Ammonia; Pb-Particulate Lead; As-Particulate Arsenic; Ni-Particulate Nickel; C_6H_6-Benzene & BaP- Benzo (a) pyrene in particulate phase levels were monitored below their respective detectable limits.

* NAAQ Norms-National Ambient Air Quality Norms-Revised as per GSR 826(E) dated 16.11.2009 for Industrial, Residential, Rural and other Area.

3.3.6 Interpretations & Conclusion

As per monitoring data, PM_{10} ranges from 31.2 µg/m³ to 60.2 µg/m³, $PM_{2.5}$ data ranges from 19.1 µg/m³ to 39.0 µg/m³, SO_2 ranges from 5.3 µg/m³ to 10.1 µg/m³ and NO_2 data ranges from 10.9 µg/m³ to 16.8 µg/m³. The concentration levels of the above criteria pollutants were observed to be well within the limits of NAAQS prescribed by CPCB.

3.3.7   FUGITIVE DUST EMISSION –

Fugitive dust was recorded at 8 AAQ monitoring stations for 30 days average during the study period.

TABLE 3.18 AVERAGE FUGITIVE DUST SAMPLE VALUES IN µg/m³

AAQ Locations	Avg SPM (µg/m³)
AAQ 1	159.5
AAQ 2	138.0
AAQ 3	190.1
AAQ 4	127.8
AAQ 5	125.7
AAQ 6	110.4
AAQ 7	106.3
AAQ 8	110.8

Source: Onsite monitoring/ sampling by Omega Laboratories

FIGURE 3.11: BAR DIAGRAM OF FUGITIVE DUST VALUES
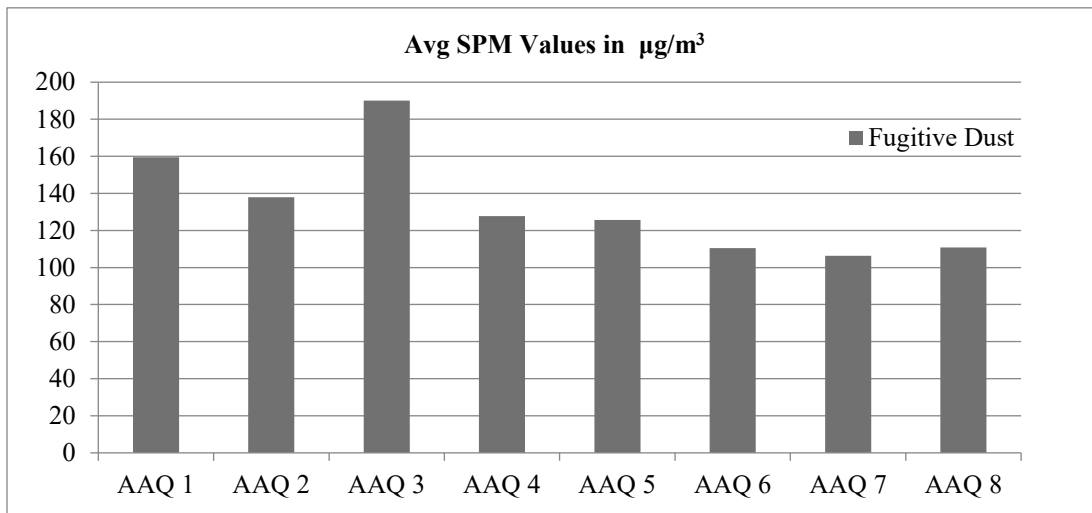
Source: Line Diagram of Table 3.16 I

TABLE 3.19: FUGITIVE DUST SAMPLE VALUES IN µg/m³ –

SPM (µg/m³)	AAQ1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7	AAQ8
Average	159.5	145	190.1	127.8	125.7	110.4	106.3	110.8
Max	161.7	147.9	192.6	128.6	128.4	111.3	107.1	111.8
Min	155.8	141.8	189.5	124.7	125.1	110	106.9	110.4

Source: Calculations from Lab Analysis Reports

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FIGURE 3.12: BAR DIAGRAM OF AMBIENT AIR QUALITY VALUES
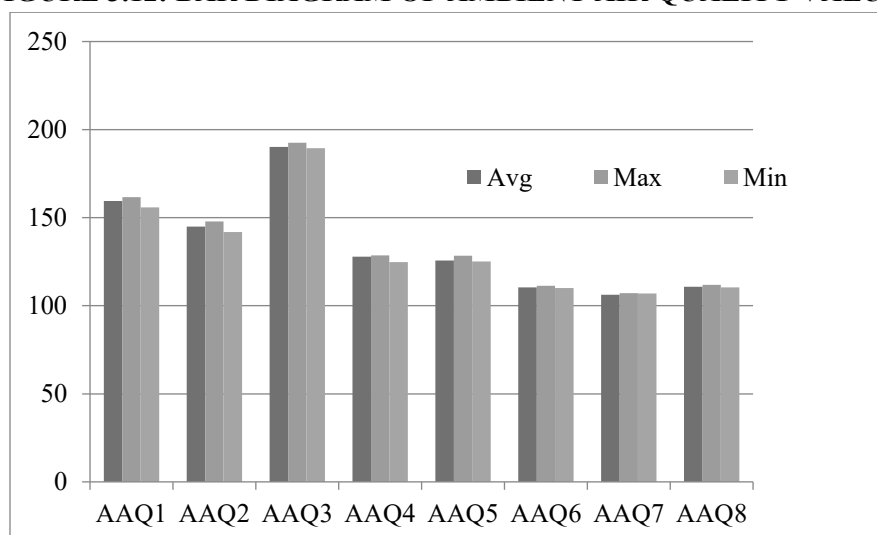
Source: Bar Diagram of table 3.16 J

3.4   NOISE ENVIRONMENT

The vehicular movement on road and mining activities is the major sources of noise in study area, the environmental assessment of noise from the mining activity and vehicular traffic can be undertaken by taking into consideration various factors like potential damage to hearing, physiological responses, and annoyance and general community responses.

The main objective of noise monitoring in the study area is to establish the baseline noise level and assess the impact of the total noise expected to be generated during the project operations around the project site.

3.4.1   Identification of Sampling Locations

In order to assess the ambient noise levels within the study area, noise monitoring was carried out at Eight (8) locations. The noise level monitoring locations were carried out by covering commercial, residential, rural areas within the radius of 10 km. A noise monitoring methodology was chosen such that it best suited the purpose and objectives of the study.

TABLE 3.20: DETAILS OF SURFACE NOISE MONITORING LOCATIONS

S. No	Location Code	Monitoring Locations	Distance & Direction	Coordinates
1	N-1	Project Area	North West Corner	10°52'24.72"N 78°22'28.21"E
2	N-2	Project Area	South Side	10°52'21.91"N 78°22'30.94"E
3	N-3	Project Area	South East Corner	10°52'20.19"N 78°22'32.97"E
4	N-4	Project Area	North East Corner	10°52'23.52"N 78°22'33.85"E
5	N-5	Kuzanthai Patti	1.0Km Southwest	10°52'3.21"N 78°21'56.90"E
6	N-6	Kodangipatti	1.5Km Southwest	10°51'36.55"N 78°22'02.91"E
7	N-7	Iyermali	1.5Km Northeast	10°52'38.36"N 78°23'19.57"E
8	N-8	Irumboothipatti	1.5Km Southeast	10°51'34.74"N 78°23'06.65"E

Source: On-site monitoring/sampling by KGS Laboratories in association with GEMS

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3.4.2   Method of Monitoring

Digital Sound Level Meter was used for the study. All reading was taken on the 'A-Weighting' frequency network, at a height of 1.5 meters from ground level. The sound level meter does not give a steady and consistent reading and it is quite difficult to assess the actual sound level over the entire monitoring period. To mitigate this shortcoming, the Continuous Equivalent Sound level, indicated by Leq, is used. Equivalent sound level, 'Leq', can be obtained from variable sound pressure level, 'L', over a time period by using following equation.

Measured noise levels, displayed as a function of time, is useful for describing the acoustical climate of the community. Noise levels recorded at each station with a time interval of about 60 minutes are computed for equivalent noise levels. Equivalent noise level is a single number descriptor for describing time varying noise levels.

Leq = 10 Log L / T$\sum$ (10Ln/10)
Where L = Sound pressure level at function of time dB (A)
T = Time interval of observation

FIGURE 3.13: NOISE MONITORING STATIONS AROUND 5KM RADIUS
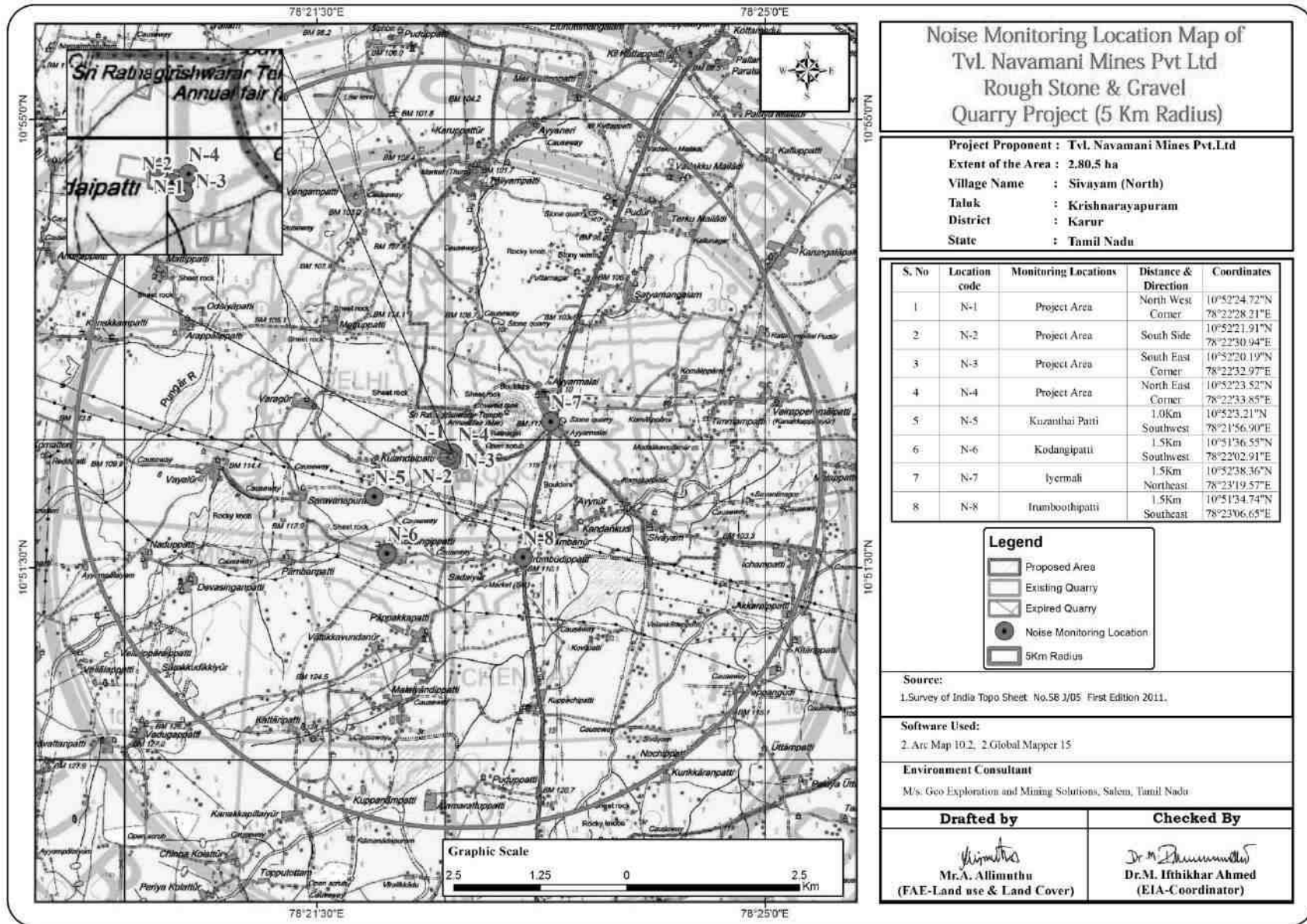
3.4.3 Analysis of Ambient Noise Level in the Study Area

The Digital Sound pressure level have been measured by a sound level meter (Model: HTC SL-1352)

An analysis of the different Leq data obtained during the study period has been made. Variation was noted during the day-time as well as night-time. The results are presented in below Table 3.6
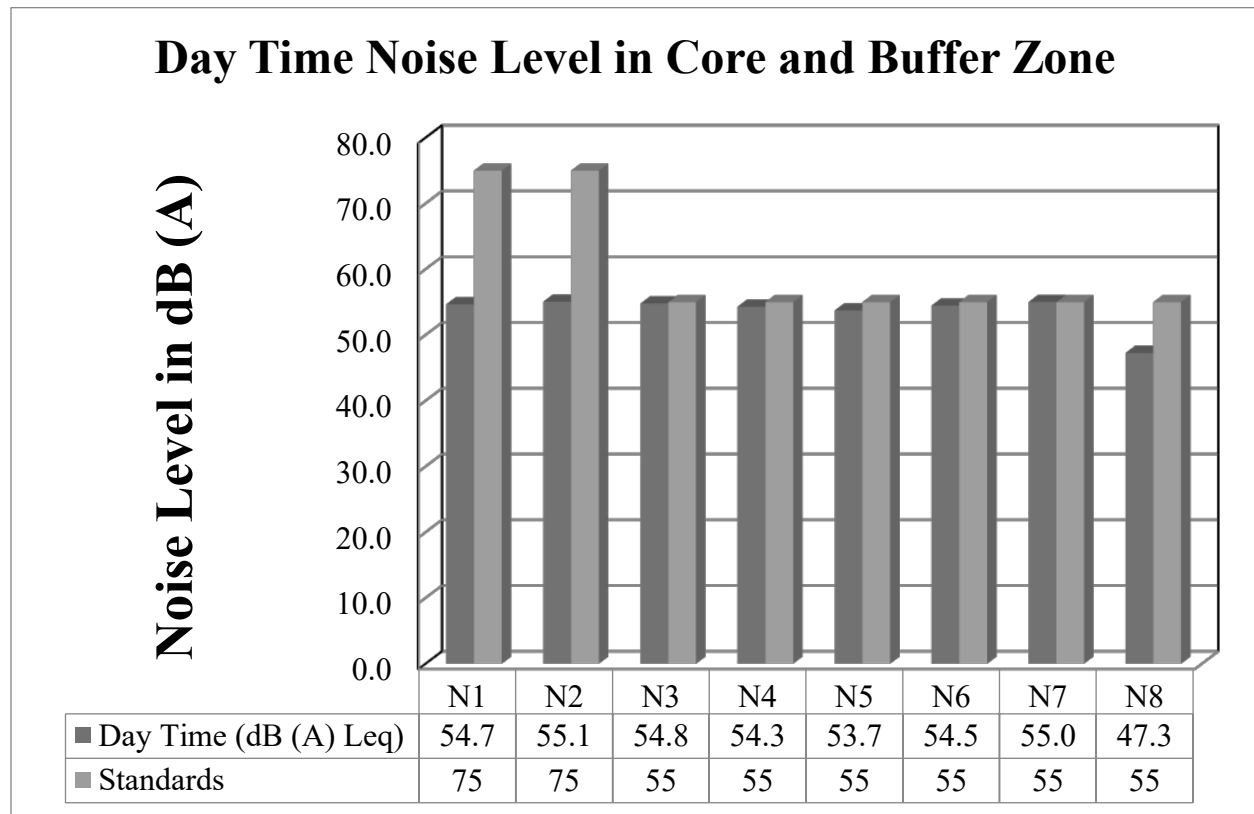
Day time: 6:00 hours to 22.00 hours.
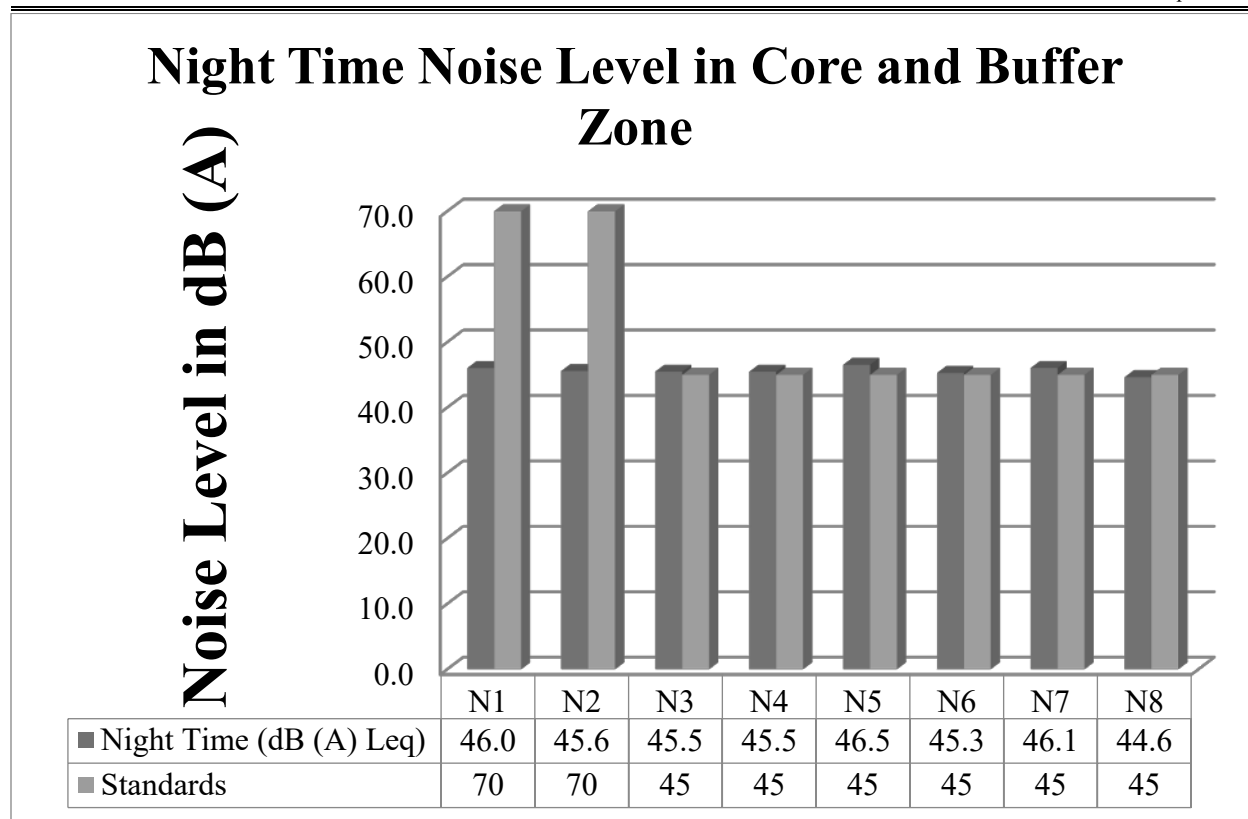
Night time: 22:00 hours to 6.00 hours.

TABLE 3.21: AMBIENT NOISE QUALITY RESULT

S. No	Locations	Noise level (dB (A) Leq)		Ambient Noise Standards
		Day Time	Night Time	
1	Core zone - North West Corner	54.7	45.8	**Industrial**
2	Core zone - South Side	55.1	45.6	
3	Core zone - South East Corner	54.8	45.3	**Day Time- 75 dB (A)**
4	Core zone - North East Corner	54.3	45.6	**Night Time- 70 dB (A)**
5	Kulanthaipatti Village	53.7	46.2	
6	Kodangipatti Village	43.1	35.6	
7	Iyermalai village	55.0	45.9	**Residential** **Day Time– 55 dB (A)**
8	Irumboothipatti village	47.2	44.8	**Night Time- 45 dB (A)**

Source: On-site monitoring/sampling by KGS Laboratories in association with GEMS

FIGURE 3.14: DAY AND NIGHT TIME NOISE LEVELS IN CORE AND BUFFER ZONE

Day Time Noise Level in Core and Buffer Zone

	N1	N2	N3	N4	N5	N6	N7	N8
Day Time (dB (A) Leq)	54.7	55.1	54.8	54.3	53.7	54.5	55.0	47.3
Standards	75	75	55	55	55	55	55	55

Night Time Noise Level in Core and Buffer Zone

	N1	N2	N3	N4	N5	N6	N7	N8
▪ Night Time (dB (A) Leq)	46.0	45.6	45.5	45.5	46.5	45.3	46.1	44.6
▪ Standards	70	70	45	45	45	45	45	45

Y-axis: Noise Level in dB (A). Values shown: 0.0, 10.0, 20.0, 30.0, 40.0, 50.0, 60.0, 70.0

3.4.4   Interpretation & Conclusion:

Ambient noise levels were measured at 8 (Eight) locations around the proposed project area.

Noise levels recorded in core zone during day time were from 54.3 – 55.1 dB (A) Leq and during night time were from 45.3 – 45.8dB (A) Leq. Noise levels recorded in buffer zone during day time were from 43.1 – 53.7 dB (A) Leq and during night time were from 35.6 – 46.2 dB (A) Leq.

The values of noise observed in some of the areas are primarily owing to quarrying activities due to cluster of quarries within 500m radius, movement of vehicles and other anthropogenic activities. Noise monitoring results reveal that the maximum & minimum noise levels at day time were recorded in the range of 59.7 dB(A) in core zone and 35.1 dB(A) in Kulanthaipatti village and 50.5 dB(A) in Kulanthaipatti Village & 36.1 dB(A) in Core zone at night time. Thus, the noise level for Industrial and Residential area meets the requirements of CPCB.

3.5   ECOLOGICAL ENVIRONMENT

There is no Forest land, National Parks, Eco sensitive areas, Wild life sanctuaries within the radius of 10 km. An ecological survey of the study area was conducted particularly with reference to the listing of species and assessment of the existing baseline ecological (terrestrial) condition in the study area.

3.5.1 Study area Ecology

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In this project, the total area of Cluster with in 10km radius from the periphery of this quarry is **8.80.0 Ha.** In such cluster situation a common Ecology and Biodiversity study for the entire cluster of quarries is enough to capture all the possible externalities. ***The common EIA/EMP data can be used for all quarries fall under this cluster.*** The Core mining area is dry land with scanty vegetation whereas in buffer zone agricultural land is dominated. The following methods were applied during the baseline study of flora, fauna and diversity assessment.

3.5.2. Objectives of Biological Studies

The present study was undertaken with the following objectives:
- ❖ To assess the nature and distribution of vegetation in and around the project site (within 10 km. radius).

1. Compilation of secondary data with respect to the study area from published literature and various government agencies
2. Generation of primary data by undertaking systematic ecological studies in the area
3. Discussion with local people so as to elicit information about local plants, animals
4. Generation of Primary Data
5. To prepare a general checklist of all plants encountered in study area. This would indicate the biodiversity for wild and cultivated plants

3.5.3. Methodology of Sampling

A methodology of Sampling Flora and fauna studies were carried out during the Winter season to assess the list of terrestrial plant and animal species that occur in the core area and the buffer area up to 10 km radius from the project site. No damage is created to flora and fauna during the sampling.

In order to provide representative ecological status for the study area, the 10-km buffer zone has been divided into four quartiles for biodiversity sampling, i.e., NE (Q-1), NW (Q-2) SW (Q-3) and SE (Q-4) is given in Fig. 4.1. Each of the quartiles have been examined for representative flora on randomly sampled quadrats for trees (25 X 25-m), shrubs (10 X 10-m) and herbs (2 X 2-m) depending upon prevailing geographical conditions and bio-diversity aspects of study area.

- Primary field surveys to establish primary baseline of the study area; and
- Compilation of information available in published literatures and as obtained from Forest survey of India, Environmental Information Centre, Botanical Survey of India and Zoological Survey of India.

The present report gives the review of published secondary data and the results of field sampling conducted during pre-monsoon, 2021 i.e. Mar to May 2021 and there are no forest blocks in study area. The detailed ecological assessment of the study area has been carried out with the following objectives:

FIGURE 3.15: QUADRATE DIAGRAM FOR FLORA RANDOM SAMPLING
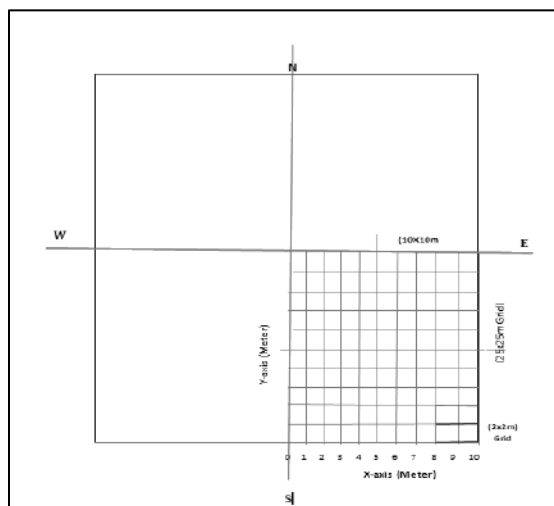
3.5.3.1.Phyto-sociological Survey method

Phyto-sociological parameters, viz., Abundance, Density, Frequency (%) were measured as per below formula. A total of 10 quadrats were laid down randomly within core area and 40 quadrats were laid down within four quartiles randomly (10/quartile) in buffer area. In core area 10 quadrats were laid randomly to enumerated trees, shrubs, and herbs as per the Following formulae used for calculating the frequency (%), abundance and density of the floral species encountered in the 10 quadrats studied.

3.5.3.2 Quadrats method

Quadrats of 25 × 25-m were laid down randomly within core and 10-km buffer area; each quadrat was laid to assess the trees (>5 cm GBH) and one, 10 × 10-m sub-quadrat nested within the quadrat for shrubs. The quadrats were laid randomly to cover the area to maximize the sampling efforts and minimize the species homogeneity, such as small stream area, trees in agricultural bunds, tank bunds, farm forestry plantations, wildlife areas, natural forest area, avenue plantations, house backyards, etc. In each quadrat individuals belonging to tree (25 × 25-m) and shrub (10 × 10-m) were recorded separately and have been identified on the field.quadrates sampling methods is given in Fig no.4.1

3.6   FLORA IN CORE ZONE

Taxonomically a total of 16 species belonging to 13 families have been recorded from the core mining lease area. Based on habitat classification of the enumerated plants the majority of species were shrubs 6 (37.5%), herbs 6 (37.5%) followed by tree 4 (25%). Baseline study of cluster area showed that very low species richness because it's fully dry area. Details of flora with the scientific name were mentioned in Table No. 4.1 and the diversity of flora families is given in Fig No.4.8.

TABLE NO: 3.22. FLORA IN CORE ZONE

SI.No	English Name	Vernacular Name	Scientific Name	Family Name
		TREES		
1	Acacia Nilotica	Karuvelam maram	*Vachellia nilotica*	Fabaceae

2	Noni	Nuna maram	*Morinda citrifolia*	Rubiaceae
3	Neem	Vembu	*Azadirachta indica*	Meliaceae
4	Millettia pinnata	Pongam oiltree	*Pongamia pinnata*	Fabaceae
SHRUBS				
5	Touch-me-not	Thottalchinungi	*Mimosa pudica*	Mimosaceae
6	Sarphonka	Katu-kolingi	*Tephrosia purpurea*	Fabaceae
7	Avaram	Avarai	*Senna auriculata*	Fabaceae
8	Milk Weed	Erukku or Crown flower	*Calotropis gigantea*	Apocynaceae
9	Wild sage	Unichedi	*Lantana camara*	Verbenaceae
10	Indian mallow	Thuththi	*Abutilon indicum*	Malvaceae
HERBS				
11	Common leucas	Thumbai	*Leucas aspera*	Lamiaceae
12	Devil's thorn	Nerunji	*Tribulus terrestris*	Zygophyllales
13	Indian doab	Arugampul	*Cynodon dactylon*	Poaceae
14	Mountain knotgrass	Poolai poondu	*Aerva lanata*	Amaranthaceae
15	Yellow-fruit Nightshade	Kantang kathrikai	*Solanum virginianum*	Solanaceae
16	Basil	Karunthulasi	*Ocimum basilicum*	Lamiaceae

3.6.1. Flora in Buffer Zone

Taxonomically a total of 44 species belonging to 29 families have been recorded from the Buffer mining lease area. Based on habitat classification of the enumerated plants the majority of species were tree 23 (50%) followed by shrubs 7 (15.21%), herbs 8 (17.39%) and Climber 8 (17.39%) is a creeper. Details of flora with the scientific name were mentioned in Table No.4.1. The diversity of flora families is given in Fig No.4.9.

TABLE NO: 3.23. FLORA IN BUFFER ZONE

Sl.No	English Name	Vernacular Name	Scientific Name	Family Name	Resource use type *(E,M,EM)
TREES					
1	Neem or Indian lilac	Vembu	*Azadirachta indica*	Meliaceae	M
2	Millettia pinnata	Pongam oiltree	*Pongamia pinnata*	Fabaceae	
3	Mango	Manga	*Mangifera indica*	Anacardiaceae	E
4	Indian fig tree	Athi	*Ficus recemosa*	Moraceae.	EM
5	Gum arabic tree	Karuvelam	*Acacia nilotica*	Mimosaceae	NE
6	Coconut	Thennai maram	*Cocos nucifera*	Arecaceae	EM
7	Asian Palmyra plam	Panai maram	*Borassus flabellifer*	Arecaceae	E
8	black plum	Navalmaram	*Sygygium cumini*	Myrtaceae	EM
9	Tamarind	Puliyamaram	*Tamarindus indica*	Legumes	EM
10	banyan tree	Alamaram	*Ficus benghalensis*	Moraceae	E
11	Guava	Koyya	*Psidium guajava*	Myrtaceae	EM
12	Teak	Thekku	*Tectona grandis*	Verbenaceae	E
13	Jack fruit	Palamaram	*Artocarpus heterophyllus*	Moraceae	E
14	Henna	Marudaani	*Lawsonia inermis*	Lythraceae	EM
15	Lemon	Ezhumuchaipalam	*Citrus lemon*	Rutaceae	EM
16	Papaya	Pappali maram	*Carica papaya L*	Caricaceae	EM
17	Indian fir tree	Nettilinkam	*Polylathia longifolia*	Annonaceae	E
18	Chinese chaste tree	Nochi	*Vitex negundo*	Verbenaceae	E
19	Noni	Nuna maram	*Morinda citrifolia*	Rubiaceae	M
20	Manilkara zapota	Sapota	*Manilkara zapota*	Sapotaceae	E

21	custard apple	seethapazham	*Annona reticulata*	Annonaceae	E
22	Curry tree	Velipparuthi	*Murraya koenigii*	Asclepiadaceae	EM
23	banana tree	Vazhaimaram	*Musa*	Musaceae	EM
SHRUBS					
24	Avaram	Avarai	*Senna auriculata*	Fabaceae	M
25	Indian mallow	Thuthi	*Abutilon indicum*	Meliaceae	M
26	Shoe flower.	Chemparuthi	*Hibiscu rosa-sinensis*	Malvaceae	EM
27	Rosary pea	Kundumani	*Abrus precatorius*	Fabaceae	M
28	Milk Weed	Erukku or Crown flower	*Calotropis gigantea*	Apocynaceae	M
29	Indian Oleander	Arali	*Nerium indicum*	Apocynaceae	M
30	Touch-me-not	Thottalchinungi	*Mimosa pudica*	Mimosaceae	M
HERBS					
31	Carrot grass	Parttiniyam	*Parthenium hysterophorus*	Asteraceae	NE
32	Holy basil	Thulasi	*Ocimum tenuiflorum*	Lamiaceae	M
33	Common leucas	Thumbai	*Leucas aspera*	Lamiaceae	M
34	Indian Copperleaf	Kuppaimeni	*Acalypha indica*	Euphorbiaceae	M
35	Red Hogweed	Mukurattai	*Boerhavia diffusa*	Nyctaginaceae	M
36	Tridax daisy	Veetukaayapoondu	*Tridax procumbens*	Asteraceae	M
37	Indian doab	Arugampul	*Cynodon dactylon*	Poaceae	E
38	European black nightshade	Manathakkali	*Solanumnigrum*	Solanaceae	EM
CLIMBER					
39	Ivy gourd	Kovai	*Coccinia grandis*	Cucurbitaceae	M
40	Balloon vine	Mudakkotan	*Cardiospermum helicacabum*	Sapindaceae	M
41	Pointed gourd	Kovakkai	*Trichosanthes dioica*	Cucurbitaceae	EM
42	butterfly pea	Karkakartum	*Clitoria ternatea*	Fabaceae	M
43	Bottle Guard	Sorakkai	*Lagenaria siceraria*	Cucurbitaceae	EM
44	stemmed vine	Perandai	*Cissus quadrangularis*	Vitaceae	M

*E- Economical, M- Medicinal, EM- Both Economical and Medicinal, NE- Not evaluated.

3.6.2. Abundance and Density

Both this term refers to the number of species in a community. Abundance of any individual species is expressed as a percentage of the total number of species present in community and therefore it is a relative measure. In sampling the abundance of species the individual of species are counted instead of just nothing their presence or absence was done while studying the frequency of a species.

Taken together abundance and frequency are of great importance in determining the community structure.

$$\text{Abundance} = \frac{\text{Total no.of individual of the species}}{\text{No of quadrate per units in which they occur}} \times 100$$

$$\text{Density} = \frac{\text{Total no.of individual of the species}}{\text{No.of quadrat per units studied}} \times 100$$

$$\text{Relative abundance} = \frac{\text{Total no.of species}}{\text{Total no.of individual of all species recorded}} \times 100$$

$$\text{Relative Density} = \frac{\text{Density of a given species}}{\text{Total densities of all the species}} \times 100$$

$$\text{\% Frequency} = \frac{\text{Density of a given species}}{\text{Total densities of all the species}} \times 100$$

Raunkiaer (1934) made an elaborative study on the frequency of species and based on his data, he divided species into 5 Classes viz, A, B, C, D, E.

Compare the observed frequency with the Raunkiaer's Law of frequency and depict it in form of histogram (Fig No: 4.2).

TABLE 3.24 : ABUNDANCE AND DENSITY OF PLANTS

S No.	Name of the plant species	Habitat	Core Zone	SE	NE	NW	SW	Total No.of Individual	No. of quadrate in which species occurred (Y)	Total quadrat studied (Z)	% freq. (Y/Z x100)	Frequency Class	Abu ndance (III/IV)	Density (III/V)
1	*Abrus precatorius*	S	0	9	6	4	4	21	4	5	80	A	5.25	4.2
2	*Acalypha indica*	H	0	11	9	6	6	30	4	5	80	B	7.5	6
3	*Abutilon indicum*	S	12	23	16	11	10	72	5	5	100	D	14.4	14.4
4	*Acacia nilotica*	T	0	9	5	6	5	25	4	5	80	B	6.25	5
5	*Aerva lanata*	H	10	18	16	8	7	59	5	5	100	C	11.8	11.8
6	*Artocarpus heterophyllus*	T	0	7	6	4	1	18	4	5	80	A	4.5	3.6
7	*Annona reticulata*	T	0	8	6	5	3	24	4	5	80	B	6	4.8
8	*Azadirachta indica*	T	10	21	18	12	10	71	5	5	100	D	14	14.2
9	*Borassus flabellifer*	T	0	15	11	14	9	49	4	5	80	C	12.25	9.8
10	*Boerhavia diffusa*	H	0	18	14	8	7	47	4	5	80	C	11.75	9.4
11	*Carica papaya L*	T	0	11	10	5	7	33	4	5	80	B	8.25	6.6
12	*Calotropis gigantea*	S	19	31	21	17	11	99	5	5	100	E	19.8	19.8
13	*Cardiospermum helicacabum*	C	0	7	5	4	5	21	4	5	80	A	5.25	
14	*Citrus lemon*	T	0	10	8	7	4	29	4	5	80	B	7.25	5.8
15	*Clitoria ternatea*	C	0	5	0	4	0	9	3	5	60	A	3	1.8
16	*Cissus quadrangularis*	C	0	8	6	5	2	21	4	5	80	A	5.25	4.2
17	*Coccinia grandis*	C	0	10	8	5	2	25	4	5	80	B	6.25	5
18	*Cocos nucifera*	T	0	23	21	18	16	78	4	5	80	D	19.5	15.6
19	*Cynodon dactylon*	H	23	19	16	17	20	79	5	5	100	D	15.8	15.8
20	*Ficus recemosa*	T	0	3	2	0	0	5	3	5	60	A	1.6	1
21	*Ficus benghalensis*	T	0	1	0	1	0	2	3	5	60	A	0.6	0.4
22	*Hibiscu rosa-sinensis*	T	0	12	10	5	0	27	3	5	60	B	9	5.4
23	*Lagenaria siceraria*	C	0	2	0	1	3	6	3	5	60	A	2	1.2
24	*Lantana camara*	S	15	28	20	11	10	84	5	5	100	E	16.8	16.8
25	*Lawsonia inermis*	T	0	7	8	4	2	21	4	5	80	A	5.25	4.2

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26	*Leucas aspera*	H	23	20	17	14	10	84	5	5	100	E	16.8	16.8
27	*Mangifera indica*	T	0	11	5	4	3	23	4	5	80	E	5.75	4.6
28	*Manilkara zapota*	T	0	2	0	0	1	3	2	5	40	A	1.5	0.6
29	*Mimosa pudica*	S	10	14	5	6	0	35	4	5	80	B	8.75	7
30	*Morinda citrifolia*	T	6	6	4	0	5	21	4	5	80	A	5.25	4.2
31	*Murraya koenigii*	T	0	4	0	1	0	5	2	5	40	A	2.5	1
32	*Musa*	T	0	9	14	8	9	40	4	5	80	B	10	8
33	*Nerium indicum*	S	0	9	8	5	2	24	4	5	80	B	6	4.8
34	*Ocimum tenuiflorum*	H	0	5	0	4	2	11	3	5	60	A	3.6	2.2
35	*Ocimum basilicum*	H	2	3	1	2	0	8	4	5	80	A	2	1.6
36	*Pongamia pinnata*	T	4	6	2	1	0	13	4	5	80	A	3.25	2.6
37	*Parthenium hysterophorus*	H	0	11	15	10	9	45	4	5	80	C	11.25	9
38	*Psidium guajava*	T	0	5	4	3	1	13	4	5	80	A	3.25	2.6
39	*Polylathia longifolia*	T	0	1	0	0	0	1	2	5	40	A	0.25	0.2
40	*Senna auriculata*	S	5	4	1	0	2	12	4	5	80	A	3	2.4
41	*Solanumnigrum*	H	0	17	15	11	13	56	4	5	80	C	14	11.2
42	*Solanum virginianum*	H	14	10	12	8	5	49	5	5	100	C	9.8	9.8
43	*Sygygium cumini*	T	0	5	0	7	1	13	3	5	60	A	4.3	2.6
44	*Tamarindus indica*	T	0	11	9	4	2	26	4	5	80	B	6.5	5.2
45	*Tectona grandis*	T	0	5	4	1	2	12	4	5	80	A	3	2.4
46	*Tephrosia purpurea*	S	8	7	2	0	0	17	3	5	60	A	5.6	3.4
47	*Trichosanthes dioica*	C	0	1	0	1	1	3	3	5	60	A	1	0.6
48	*Tridax procumbens*	H	0	28	22	18	16	84	4	5	80	E	21	16.8
49	*Tribulus terrestris*	H	5	3	4	1	1	14	5	5	100	A	2.8	2.8
50	*Vachellia nilotica*	T	12	14	10	8	5	49	5	5	100	C	9.8	9.8
51	*Vitex negundo*	T	0	8	6	4	3	21	4	5	80	A	5.25	4.2

On the basis of per cent values various species distribute into five frequency class

Frequency percentage	Class
0-20	A
21-40	B
41-60	C
61-80	D
81-100	E

A graph is plotted (Histogram) with frequency class on X-axis and frequency percentage on Y-axis and compared with Raunkier's value.

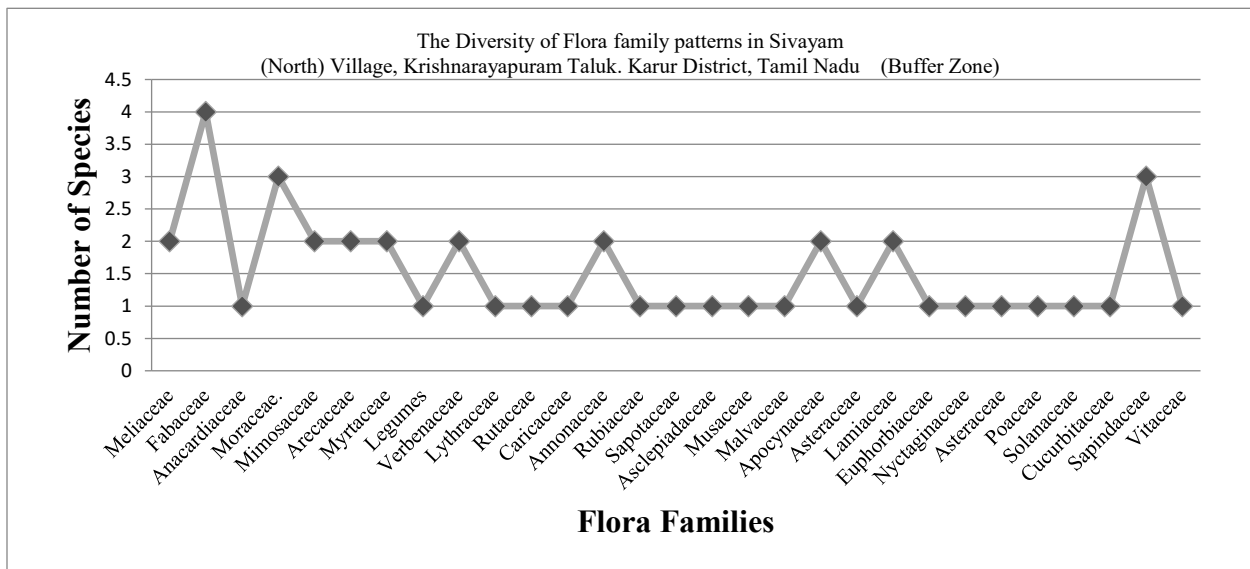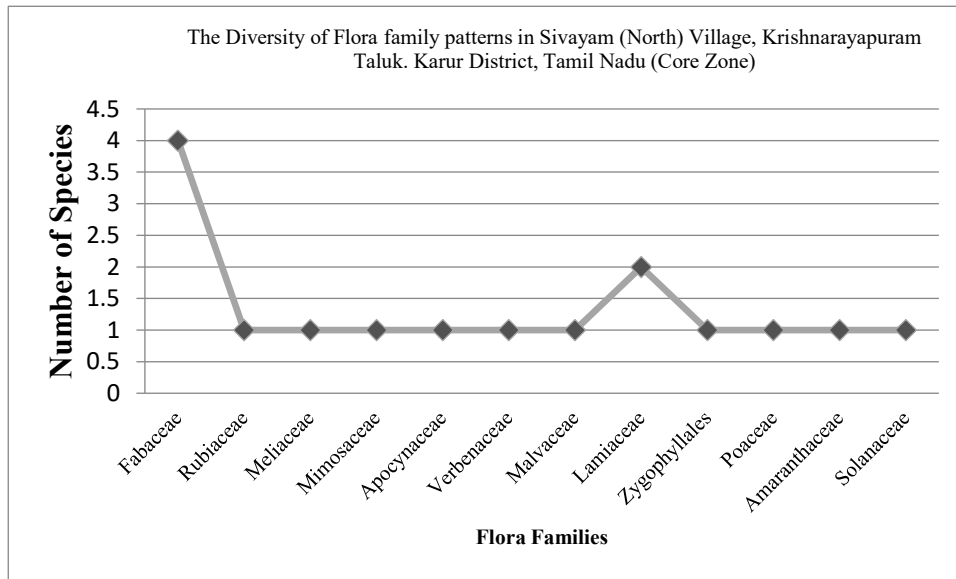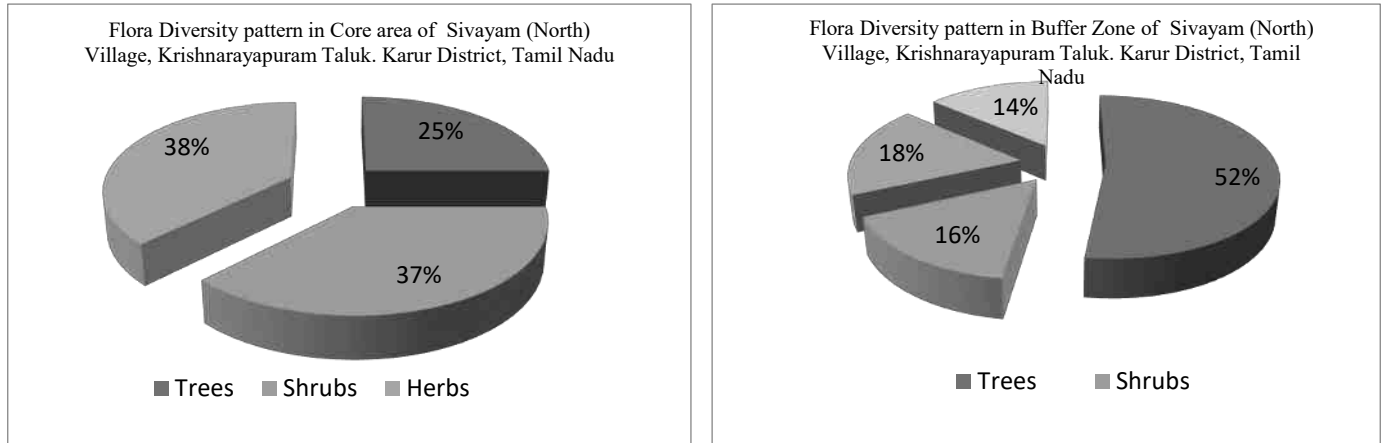### FIGURE 3.15: BAR DIAGRAM - FREQUENCY CLASS OF VEGETATION
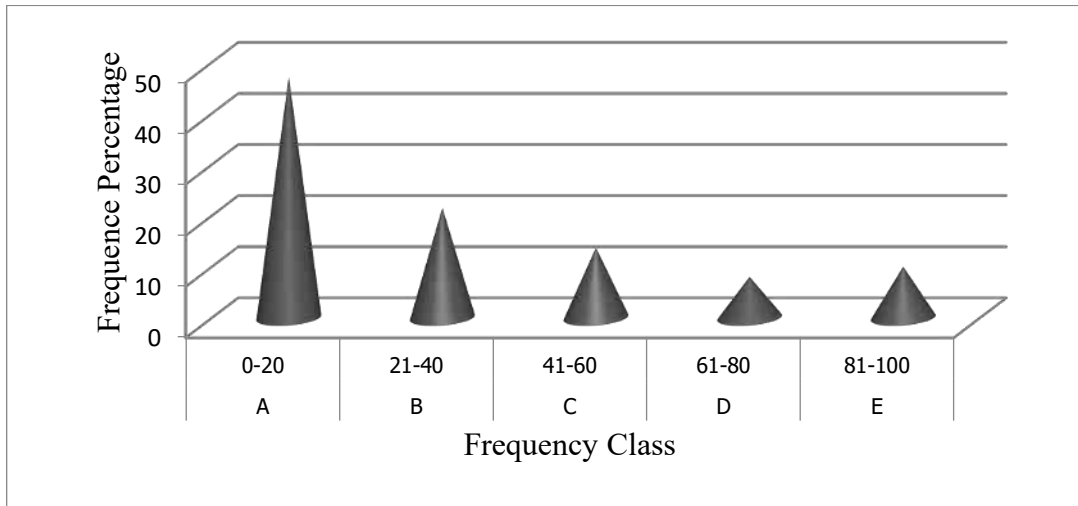
Frequency class	Class value	Raunkier's value	Frequency class of vegetation
A	0-20	53	47.05
B	21-40	14	21.5
C	41-60	9	13.7
D	61-80	8	8
E	81-100	16	10

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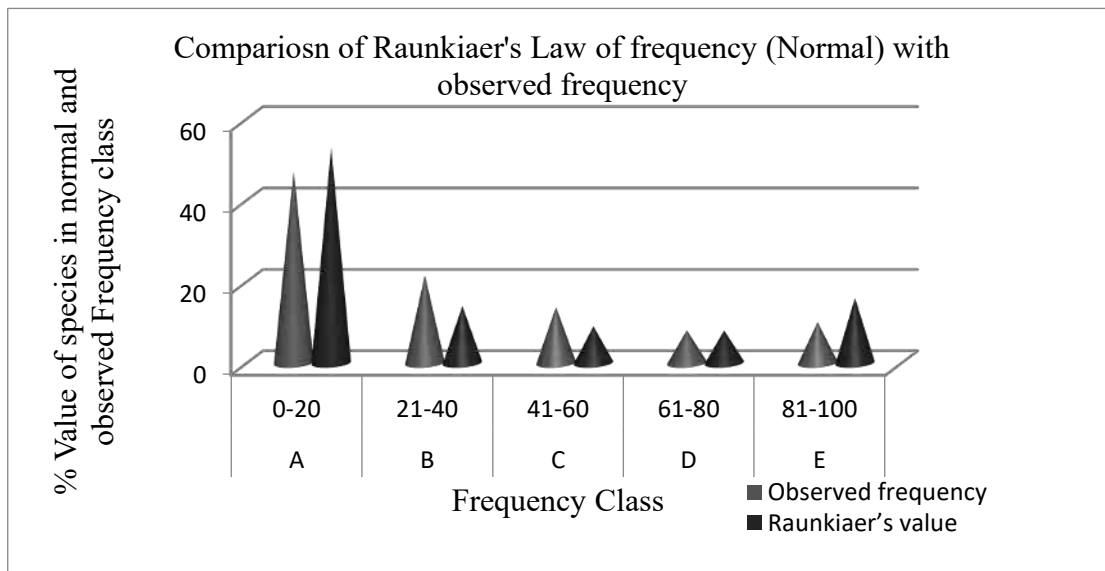
Histogram representing comparison of Raunkiaer's law of frequency (normal) with observed frequency (from table No.4.3.).

FIGURE 3.16: PIE DIAGRAM – FLORA DIVERSITY PATTERN

Flora Diversity pattern in Core area of Sivayam (North) Village, Krishnarayapuram Taluk. Karur District, Tamil Nadu

Flora Diversity pattern in Buffer Zone of Sivayam (North) Village, Krishnarayapuram Taluk. Karur District, Tamil Nadu

The Diversity of Flora family patterns in Sivayam (North) Village, Krishnarayapuram Taluk. Karur District, Tamil Nadu (Core Zone)

The Diversity of Flora family patterns in Sivayam (North) Village, Krishnarayapuram Taluk. Karur District, Tamil Nadu (Buffer Zone)

3.6.3 Interpretation of result:

Frequency data obtained indicates whether the distribution of the species is homogenous i.e. uniform throughout the buffer zone or heterogeneous.

Heterogeneous distribution refers to the uneven distribution of various species within a specific area.

Even observed % frequency classes (A_B_C_D) Differs from the normal Frequency Law of Raunkiae's as expected since the area under the study is highly disturbed due to various biotic factors i.e. (A>B>C>=<D<E).

In the present study class E is less, which indicates highly disturbed area and its dry land with scanty vegetation.

4.7. FAUNA

The faunal survey has been carried out as per the methodology cited and listed out Mammals, birds, Reptiles, Amphibians and Butterflies. All the listed species were compared with Red Data Book and Indian Wildlife Protection Act, 1972. There are no rare, endangered, threatened (RET) and endemic species present in core area.

4.7.1. Fauna methodology

The study of fauna takes substantial amount of time to understand the specific faunal characteristics of the area. The assessment of fauna has been done on the bases of primary data collected from the lease sites. The presence was also confirmed from the local inhabitants depending on the animal sightings and the frequency of their visits in the project area. In addition officials, local peoples were another source of information for studying the fauna of the area. Field activities are physical/active search, covering rocks, burrows, hollow inspection and location of nesting sites and habitat assessment etc.,

Taxonomical identification was done by the field guide book and wildlife envis data base (wiienvis.nic.in/Database/Schedule Species Database) and Zoological Survey of India (ZSI). Detailed faunas are mentioned in the Table No. 4.7.

a)   Survey and Monitoring of Mammals

Intensive survey has been done by line transect methods (Walking and in vehicle) for all major habitats for surveying of mammals by direct and indirect evidence. Indirect methods such as faecal matter (i.e., scat) and pug mark by establishing 10×100-m linear transects depending on the habitat (i.e., existing wildlife game routes/forest trails used).

Direct observation technique has been used for surveying large and medium sized mammals. But this technique is perfectly suitable for surveying of diurnal mammals; however, good photographs were also taken for species identification.

b)   Survey and Monitoring of Birds

Birds are sampled by using point count methods, and opportunistic bird sightings. By this bird vocal sounds and photographs, the species were identified in consultation with village local people.

Point count: in this methods, the observer will stand in a randomly chosen point and birds seen or heard in 50m radius are recorded for 5-min. this observation is repeated in another point at least 30m from the first point. We have enumerated 20 point – counts in each quartile, which constitute a total of 80 points-count (20 x 4) within 10 km radius area.

Opportunistic bird sightings: while traveling in study area, many bird species will be detected in survey time. Such species are recoded by their appearance or by their call.

c)   Survey and Monitoring of reptiles

Several survey techniques such as standard walk transect visual encounter survey methods were used to sampling reptiles in each and every habitat of the study area. While doing this survey, photographs were taken for identification of species. Species identification was done by using standard field guides in consultation with village people expert.

The **butterfly** was enumerated by 2 linear transects of 10 × 100 m were laid within each quartile at minimum interval of 1 km. Further, **amphibians and fishes** documented in existing literature and secondary information in consultation with local people and wildlife experts.

4.7.2. Fauna in Core Zone

Species composition, Distribution and Conservation status

Taxonomically a total of 17 species belonging to 15 families have been recorded from the core mining lease area. Based on habitat classification the majority of species were birds 5 (29.41%) followed by insects 8 (47%), mammals 1 (6%) and reptiles 3 (18%). Dominant species are mostly birds and insects no amphibians were observed during the extensive field visit. There are no critically endangered, endangered, vulnerable and endemic species were observed. Details of fauna in core zone with the scientific name were mentioned in Table No. 4.7.

TABLE NO: 3.25. FAUNAL DIVERSITY IN CORE ZONE

SI. No	Common name/English Name	Family Name	Scientific Name	Schedule list wildlife Protection act 1972	IUCN Red list data
INSECTS					
1	Acraea violae	Nymphalidae	*Acraea violae*	NL	LC
2	Mottled emigrant	Peridae	*Catopsilia pyranthe*	NL	LC
3	Striped tiger	Nymphalidae	*Danaus plexippus*	Schedule IV	LC
4	Praying mantis	Mantidae	*mantis religiosa*	NL	NL
5	Grasshopper	Acrididae	*Hieroglyphus sp*	NL	LC
6	Red-veined darter	Libellulidae	*Sympetrum fonscolombii*	NL	LC
7	Termite	Blattodea	*Hamitermes silvestri*	NL	LC
8	Stick insect	Lonchodidae	*Carausius morosus*	NL	LC
REPTILES					
9	Garden lizard	Agamidae	*Calotes versicolor*	NL	LC
10	Common house gecko	Gekkonidae	*Hemidactylus frenatus*	NL	LC
11	Fan-Throated Lizard	Agamidae	*Sitanaponticeriana*	NL	LC
MAMMALS					
12	Indian Field Mouse	Muridae	*Mus booduga*	Schedule IV	NL
AVES					
13	Asian green bee-eater	Meropidae	*Meropsorientalis*	NL	LC
14	Common myna	Sturnidae	*Acridotheres tristis*	NL	LC
15	House crow	Corvidae	*Corvussplendens*	NL	LC
16	Cattle egret	Ardeidae	*Bubulcus ibis*	NL	LC
17	Koel	Cucalidae	*Eudynamys*	Schedule IV	LC

4.7.3. Fauna in Buffer Zone

Taxonomically a total of 26 species belonging to 19 families have been recorded from the buffer mining lease area. Based on habitat classification the majority of species were insects 12 (46%) followed by birds 9 (35%), mammals 2 (8%) and reptiles 3 (11%). There are no critically endangered, endangered, vulnerable and endemic species were observed. The Diversity of Faunal family patterns is given in fig no 4.10.
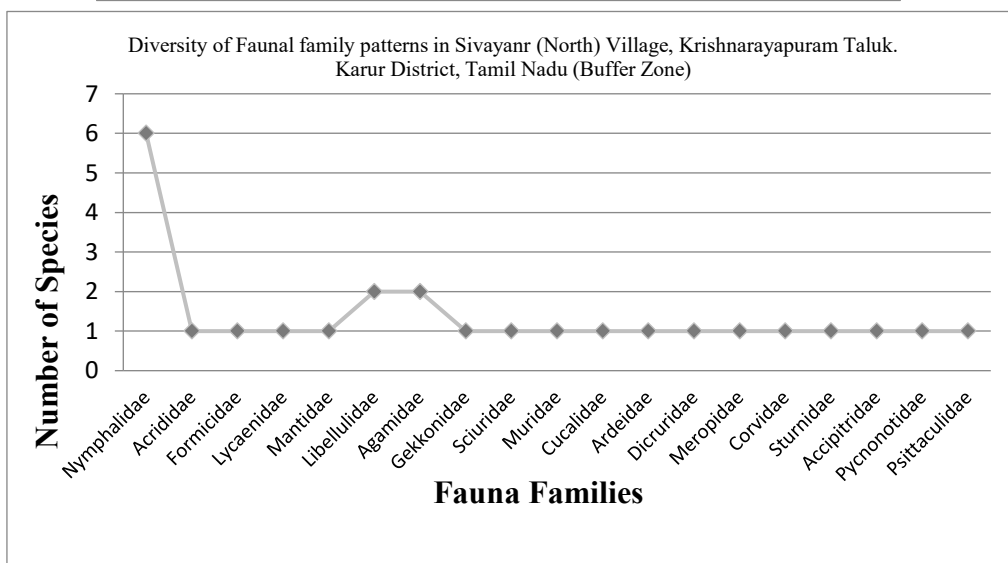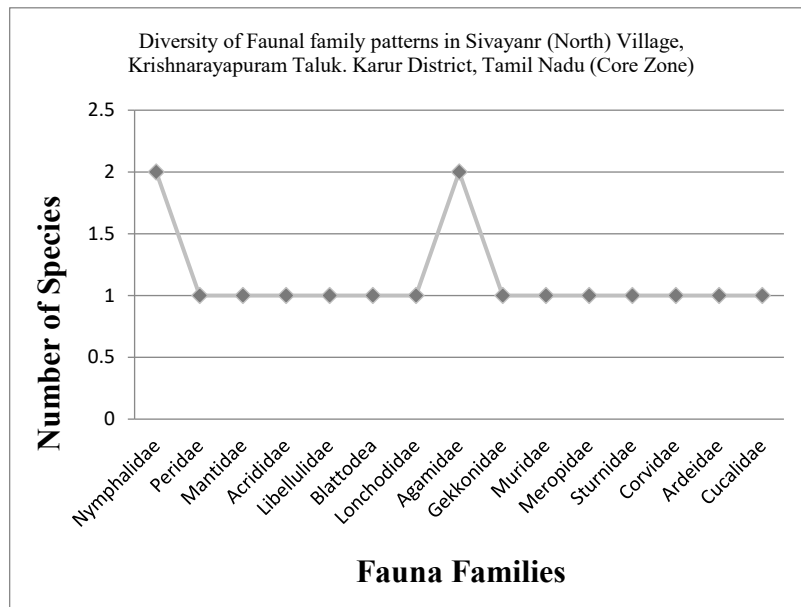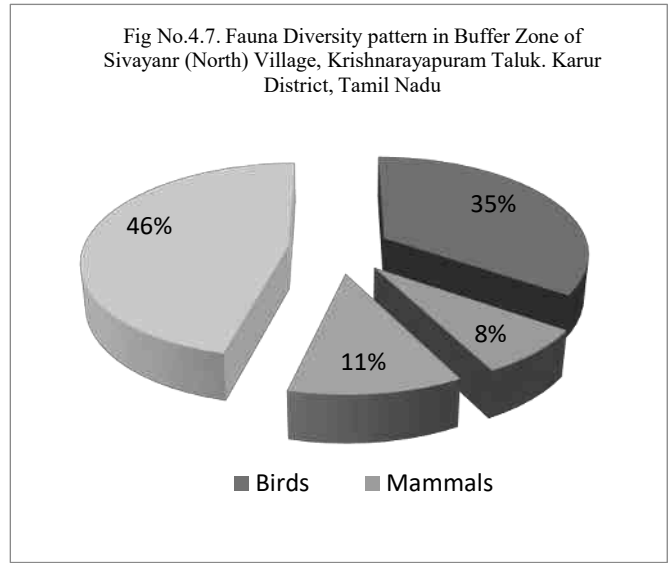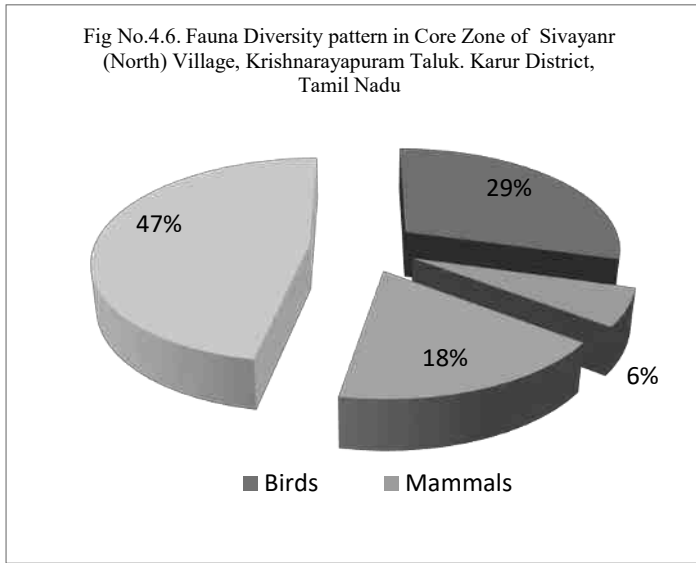
TABLE NO: 3.26. FAUNAL DIVERSITY IN BUFFER ZONE

SI. No	Common name/English Name	Family Name	Scientific Name	Schedule list wildlife Protection act 1972	IUCN Red List data
INSECTS					
1	Tawny coster	Nymphalidae	*Danaus chrysippus*	Schedule IV	LC
2	Common Indian crow	Nymphalidae	*Euploea core*	Schedule IV	LC
3	Common Tiger	Nymphalidae	*Danaus genutia*	Schedule IV	LC
4	Grasshopper	Acrididae	*Hieroglyphus sp*	NL	LC
5	Striped tiger	Nymphalidae	*Danaus plexippus*	Schedule IV	LC
6	Ant	Formicidae	*Camponotus Vicinus*	NL	NL
7	Lesser grass blue	Lycaenidae	*Zizina Otis indica*	Schedule IV	LC
8	Praying mantis	Mantidae	*mantis religiosa*	NL	NL
9	Green marsh hawk	Libellulidae	*Orthetrum sabina*	NL	LC
10	Red-veined darter	Libellulidae	*Sympetrum fonscolombii*	NL	LC
11	Milkweed butterfly	Nymphalidae	*Danainae*	NL	LC
12	Blue tiger	Nymphalidae	*Tirumala limniace*	Schedule IV	LC
REPTILES					
13	Garden lizard	Agamidae	*Calotes versicolor*	NL	LC
14	Common house gecko	Gekkonidae	*Hemidactylus frenatus*	NL	LC
15	Fan-Throated Lizard	Agamidae	*Sitanaponticeriana*	NL	LC
MAMMALS					
16	Indian palm squirrel	Sciuridae	*Funambulus palmarum*	Schedule IV	LC
17	Indian Field Mouse	Muridae	*Mus booduga*	Schedule IV	LC
AVES					
18	Koel	Cucalidae	*Eudynamys*	Schedule IV	LC
19	Cattle egret	Ardeidae	*Bubulcus ibis*	NL	LC
20	Black drongo	Dicruridae	*Dicrurus macrocercus*	Schedule IV	LC
21	Asian green bee-eater	Meropidae	*Meropsorientalis*	NL	LC
22	House crow	Corvidae	*Corvussplendens*	NL	LC
23	Common myna	Sturnidae	*Acridotheres tristis*	NL	LC
24	Shikra	Accipitridae	*Accipiter badius*	NL	LC
25	Red-vented Bulbul	Pycnonotidae	*Pycnonotuscafer*	Schedule IV	LC
26	Rose-ringed parkeet	Psittaculidae	*Psittacula krameri*	NL	LC

NL- Not listed, LC- Least concern, NT- Near threatened

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FIGURE 3.17: PIE DIAGRAM FAUNA DIVESITY PATTERN

Fig No.4.6. Fauna Diversity pattern in Core Zone of Sivayanr (North) Village, Krishnarayapuram Taluk. Karur District, Tamil Nadu

47%   29%   18%   6%

■ Birds   ■ Mammals

Fig No.4.7. Fauna Diversity pattern in Buffer Zone of Sivayanr (North) Village, Krishnarayapuram Taluk. Karur District, Tamil Nadu

46%   35%   11%   8%

■ Birds   ■ Mammals

Diversity of Faunal family patterns in Sivayanr (North) Village, Krishnarayapuram Taluk. Karur District, Tamil Nadu (Core Zone)

Diversity of Faunal family patterns in Sivayanr (North) Village, Krishnarayapuram Taluk. Karur District, Tamil Nadu (Buffer Zone)

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3.7.4 Interpretation

The result of core & Buffer zone of fauna studies shows that Nymphalidae and *Agamidae* are the main dominating species in the study area it mentioned in Table No.4.7 & 4.8. There is no schedule I & II Species in study area. A detail of fauna diversity of family's pattern is given in Fig No.4.9. There are no critically endangered, endangered, vulnerable and endemic species were observed. Details of faunal diversity in buffer zone are given in Table No.4.8.

3.7   SOCIO ECONOMIC ENVIRONMENT

There is no habitation/ village within the radius of 1km from the project area. Socio-economic study is an essential part of environmental study. It includes demographic structure of the area, provision of basic amenities viz., housing, education, health and medical services, occupation, water supply, sanitation, communication, transportation, prevailing diseases pattern as well as feature like temples, historical monuments etc., at the baseline level. This will help in visualizing and predicting the possible impact depending upon the nature and magnitude of the project.

It is expected that the Socio Economic Status of the area will substantially improve because of this proposed project. As the proposed project will provide direct and indirect employment and improve the infrastructural facilities in that area and, thus, improve their standard of living.

3.7.1   Objectives of the Study

The objectives of the socio-economic study are as follows:

- To study the socio-economic status of the people living in the study area of the proposed mining project
- To assess the impact of the project on Quality of life of the people in the study area
- To recommend Community Development measures needs to be taken up in the study Area.

3.7.2   Scope of Work

- To study the Socio-economic Environment of the area from the secondary sources;
- Data Collection & Analysis
- Prediction of project impact
- Mitigation Measures

3.7.3   Administrative Setup of Karur District

Karur district includes 2 Revenue Divisions, 5 Taluks, 8 Community Development Blocks, 4 Municipalities, 11 Town Panchayats and 4 Census Towns. There are 170 Revenue Villages in this district, of these 169 villages are inhabited.

In 2011, Karur district had population of 10,64,493 of which male and female were 5,28,184 and 5,36,309 respectively.

3.7.4   Study area

As per the Population Census 2011, there are total 491 families residing in the village Sivayam (North). The **total population of Sivayam (North) is 7340** out of which 7340 are males and 3662 are females thus the **Average Sex Ratio of Sivayam (North) is 200**. Literacy rate is 57% Male literacy stands at 57.59 % while female literacy rate was 42.4 %. Schedule Caste (SC) constitutes 19.6%. No ST population in the Sivayam (North) Village.

 In Sivayam (North) village out of total population, 7340 were engaged in work activities. 52.7 % of workers describe their work as Main Work (Employment or Earning more than 6 Months)

TABLE 3.27: POPULATION CHARACTERISTICS AROUND 10KM RADIUS

Total No of Villages	No. of Households	Total Population	Population Male	Population female	SC Population Male	SC Population female	Total Literate	Total Literates Male	Total Literates Female	Total Illiterates Male	Total Illiterates Female
26	31,593	1,25,067	62,236	62,831	13,810	14,478	77,961	43,901	34,060	18,335	28,771

TABLE 3.28: OCCUPATIONAL CHARACTERISTICS AROUND 10KM RADIUS

Total Worker Population Male	Total Worker Population Female	Main Working Population Male	Main Working Population Female	Main Cultivator Population Male	Main Cultivator Population Female	Main Agricultural Labourers Population Male	Main Agricultural Labourers Population Female	Non Working Population Male	Non Working Population Female
38,152	28,662	36,264	25,984	7,369	3,736	17,982	18,419	24,084	34,169

3.7.5 Basic Amenities

A better network of physical infrastructure facilities (well-built roads, rail links, irrigation, power and telecommunication, information technology, market-network and social infrastructure support, viz. health and education, water and sanitation, veterinary services and co-operative) is essential for development of the rural economy. A review of infrastructure facilities available in the area has been given on the basis of field survey. In this study the villages which fall within 10 km radius around the site has been covered. Infrastructure facilities available in the area are presented below.

All basic amenities Education (higher education, colleges, universities, Medical college, Transport facilities, Railway station, Bus station area available in the district headquarters Karur at a distance of 33 km – North West)

3.7.6 Recommendation and Suggestion

- Awareness program to be conducted to make the population aware to get education and a better livelihood.
- Health care centre and ambulance facility can be provided to the population to get easy and accessible medical facilities.
- Vocational training programme can be organized to make the people self - employed, particularly for women and unemployed youth.
- On the basis of qualification and skills local community may be preferred
- Long term and short term employments can be generated
- Maternity facility should be made available at the place to avoid going too far off places for treatment which involves risks. Apart from that as these areas are prone to various diseases a hospital with modern facilities should be opened on a priority basis in a central place to provide better health facilities to the villagers around the project
- While developing an Action Plan, it is very important to identify the population who falls under the marginalized and vulnerable groups. So that special attention can be given to these groups with special provisions while making action plans

3.7.7 Conclusion

The socio economic study of surveyed villages gives a clear picture of its population, average household size, literacy rate and sex ratio etc. It is also found that a part of population is suffering from lack of permanent job to run their day to day life. Their expectation is to earn some income for their sustainability on a long-term basis.

The proposed project will aim to provide preferential employment to the local people there by improving the employment opportunity in the area and in turn the social standards will improve. The nearby villages within 5kms radius has PHC, Anganwadi school, post office, telegram, Educational facilities, bus connectivity and all other amenities required for healthy standard of life.

4. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

4.0   GENERAL

Environmental impacts both direct and indirect on various environmental attributes due to proposed mining activity will be created in the surrounding environment, during the operational and post–operational phases. The occurrence of mineral deposits, being site specific, their exploitation, often, does not allow for any choice except adoption of eco-friendly operation. The methods are required to be selected in such a manner, so as to maintain environmental equilibrium ensuring sustainable development.

In order to maintain the environmental commensuration with the mining operation, it is essential to undertake studies on the existing environmental scenario and assess the impact on different environmental components. This would help in formulating suitable management plans sustainable resource extraction.

The following parameters are of significance in the Environmental Impact Assessment and are being discussed in detail

- Land environment
- Soil environment
- Water Environment
- Air Environment
- Noise Environment
- Socio economic environment
- Biological Environment

Based on the baseline environmental status at the project site, the environmental factors that are likely to be affected (Impacts) are identified, quantified and assessed.

4.1   LAND ENVIRONMENT

4.1.1   Anticipated Impact

The main anticipated impact on the Land Environment due to quarrying operation is change in Landscape, change in Land – use Pattern. The total area applied for quarry lease is 2.80.5 Ha, the total extent of the cluster is 8.80.0 Ha including existing and proposed quarries in patta land. The ultimate depth of the proposed project is quarrying is varies from 38m below the ground level and will not intersect the ground water table. The project is site specific.

4.1.2 Mitigation measures

Due to the quarrying activities in the project the land use pattern will be altered. In order to minimize the adverse effects, the following control measures will be implemented:

- In the Rough stone and Gravel quarrying operation the degradation of land is insignificant, after completion of the quarrying operation the land will be allowed to collect rain water which will act as temporary reservoir, this rough stone does not produce any toxic effluents in the form of solid, liquid or gas
- The periphery of the mining lease area will be converted to a greenbelt to prevent Noise and sound propagation to the nearby lands
- Construction of garland drains all around the quarry pit and construction of check dam at strategic location in lower elevations to prevent soil erosion due to surface runoff during rainfall and also to collect the storm water for various uses within the proposed area
- Barbed wire fencing will be carried out at the conceptual stage, Security will be posted round the clock, to prevent inherent entry of the public and cattle

4.1.3 Soil Environment
4.1.4 Impact on Soil Environment

Mining operations routinely modify the surrounding landscape by exposing previously undisturbed earthen materials. There is no top soil in this project, the surface consists of gravelly formation, hence preservation of top soil does not exist. Erosion of top layer (gravel), extracted fine material can result in substantial sediment loading to surface waters and drainage ways. During rainy season surface run off may cause siltation in low lying areas.

4.1.5 Mitigation measures for Soil Erosion and Soil Conservation

▪ Garland drains will be constructed around the project area with silt traps to control the soil erosion during rainy seasons.

▪ Greenbelt development all along the periphery of the project area (i.e., 7.5m safety barrier) will ensure binding strength and minimizes soil erosion.

▪ Soil sampling will be carried out in the core zone for every six months to ensure the soil quality is not affected due to the quarrying activities.

4.2   WATER ENVIRONMENT

4.2.1 Anticipated Impact on Surface and ground water

The impact due to quarrying on the water quality is expected to be insignificant because of no use of chemicals or hazardous substances during quarrying process. The proposed depth of this project is 38m and water table is found at a depth of 50 - 55m BGL the quarrying activity will not intersect ground water table.

The quarrying operation will be carried out well above the water table. There is no intersection of surface water bodies (Streams, Canal, Odai etc.,) in the project area. During rainy season rain water will be collected in the quarry pit and later used for greenbelt development and for the water sprinkling in the haul roads. There is no proposal for discharging of quarry pit water outside the project area

There is no proposal Rough stone processing or workshop within the project area thus there is no effluent anticipated in the mine.

Detail of water requirements in KLD as given below:

TABLE 4.1: WATER REQUIREMENTS FOR THE CLUSTER

*Purpose	Quantity	Source
Dust Suppression	1.5 KLD	Rainwater accumulated in Mine Pit/ Water Tanker
Green Belt development	1.0 KLD	Rainwater accumulated in Mine Pit/ Water Tanker
Drinking and Domestic purpose	1.5 KLD	Water Tankers
Total	4.0 KLD	

* Water for drinking purpose will be brought from approved water vendors
Source: Approved Mining Plan Pre-Feasibility Report

4.2.2 Mitigation measures

The following mitigation measures are suggested for water management
• Rainwater will be collected in lower part of the quarry pit by construction of garland drains to divert surface run-off and will be connected to setting tank of 5 m (l) x 5m (w) x 3m (d) to allow suspended solids to settle down if any. This collected water will act as a rain water harvesting system and will be used for dust suppression and greenbelt development
• Six month once analysis of quarry pit water and ground water quality in nearby villages will be carried out to ensure the water quality is not affected due to the quarrying activities
• Domestic sewage from site office & urinals/latrines provided in project area will be discharged through septic tank followed by soak pit system

- Only clear and settled water free from silt content will be used for dust suppression and plantation purposes
- De-silting will be carried out before and immediately after the monsoon season and the settling tank and drains will be cleaned weekly, especially during monsoons
- Tippers & HEMM will be washed in a designated area and the washed water will be routed through drains to a settling tank, which has an oil & grease trap, only clear water will be reused for greenbelt development

4.3   AIR ENVIRONMENT

The air borne particulate matter is the main air pollutant in this opencast mining. The mining operation will be carried out by jackhammer drilling (35mm dia) and Hydraulic Excavators will be utilized for excavation of Rough Stone and Gravel.

4.3.1. Anticipated Impact

Wind erosion of the exposed areas and the air borne particulate matter generated by quarrying operation, and transportation are mainly PM_{10} & $PM_{2.5}$ and emissions of Sulphur dioxide (SO_2) & Oxides of Nitrogen (NOx) due to excavation/loading equipment and vehicles plying on haul roads are the cause of air pollution in the project area.

Similarly, loading - unloading and transportation of Rough Stone and Gravel, wind erosion of the exposed area and movement of light vehicles will be a cause of pollution due to quarrying activities within a radius of 500 meters from the project area. This leads to a cumulative impact on the ambient air environment around the project area.

Anticipated incremental concentration due to this quarrying activity and net increase in emissions due to quarrying activities within 500 meters around the project area is predicted by Open Pit Source modelling using AERMOD Software.

4.3.2.1 Emission Estimation

An emissions factor is a representative value that attempts to relate the quantity of a pollutant released to the atmosphere with an activity associated with the release of that pollutant.
The general equation for emissions estimation is:

$$E = A \times EF \times (1-ER/100)$$

Where:
E = emissions;
A = activity rate;
EF = emission factor, and
ER =overall emission reduction efficiency, %

The proposed mining activity includes various activities like ground preparation, excavation, handling and transport of ore. These activities have been analysed systematically basing on USEPA-Emission Estimation Technique Manual, for Mining AP-42, to arrive at possible emissions to the atmosphere and estimated emissions are given in Table 4-2.

TABLE 4.2: ESTIMATED EMISSION RATE FOR PM_{10}

Activity	Source type	Value	Unit
Drilling	Point Source	0.123080351	g/s
Blasting	Point Source	0.001037626	g/s
Mineral Loading	Point Source	0.046813500	g/s
Haul Road	Line Source	0.002580263	g/s/m
Overall Mine	Area Source	1.255619403	g/s

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TABLE 4.3: ESTIMATED EMISSION RATE FOR SO$_2$

Activity	Source type	Value	Unit
Overall Mine	Area Source	0.02554754	g/s

TABLE 4.4: ESTIMATED EMISSION RATE FOR NO$_X$

| Activity	Source type	Value	Unit
Overall Mine	Area Source	0.086958405	g/s

4.3.2 Frame work of Computation & Model details

By using the above-mentioned inputs, ground level concentrations due to the quarrying activities have been estimated to know the incremental concentration in ambient air quality and impact in the study area. The effect of air pollutants upon receptors are influenced by concentration of pollutants and their dispersion in the atmosphere. Air quality modelling is an important tool for prediction, planning and evaluation of air pollution control activities besides identifying the requirements for emission control to meet the regulatory standards and to apply mitigation measures to reduce impact caused by quarrying activities. PM$_{10}$ was the major pollutant occurred during quarrying activities. The prediction included the impact of Excavation, Drilling, Blasting, loading and movement of vehicles during transportation and meteorological parameters such as wind speed, wind direction, temperature, rainfall, humidity and Cloud cover.

Impact was predicted over the distance of 10 km around the source to assess the impact at each receptor separately at the various locations and maximum incremental GLC value at the project site. Maximum impact of PM$_{10}$ was observed close to the source due to low to moderate wind speeds. Incremental value of PM$_{10}$ was superimposed on the base line data monitored at the proposed site to predict total GLC of PM$_{10}$ due to combined impacts.

FIGURE 4.1: AERMOD TERRAIN MAP
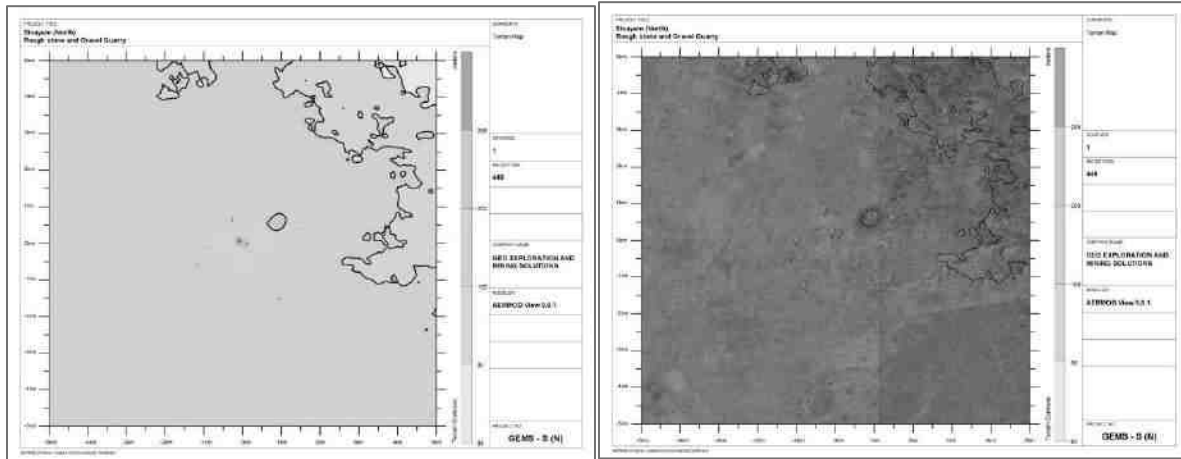
FIGURE 4.2: PREDICTED INCREMENTAL CONCENTRATION OF PM$_{10}$
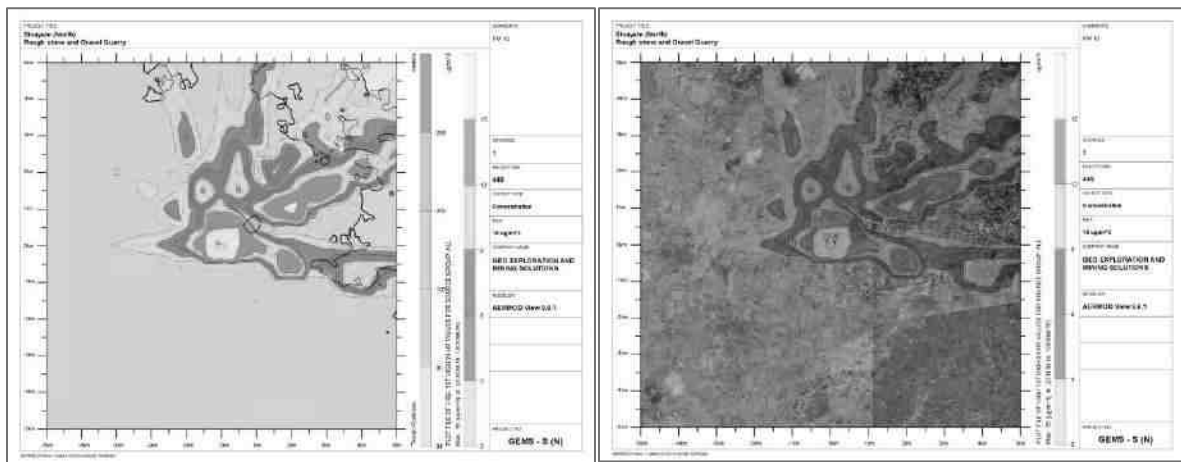
FIGURE 4.2: PREDICTED INCREMENTAL CONCENTRATION OF PM$_{2.5}$
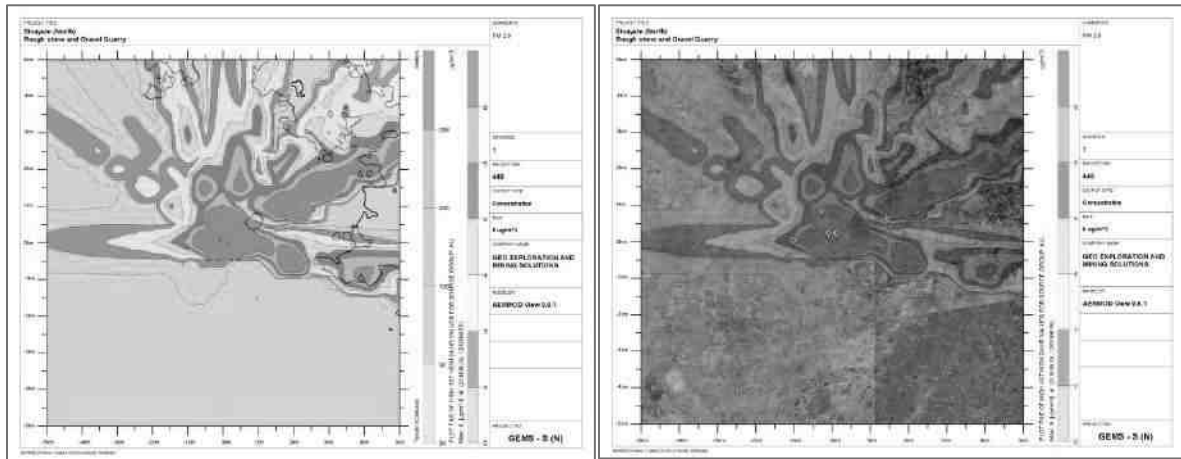
FIGURE 4.3: PREDICTED INCREMENTAL CONCENTRATION OF SO₂
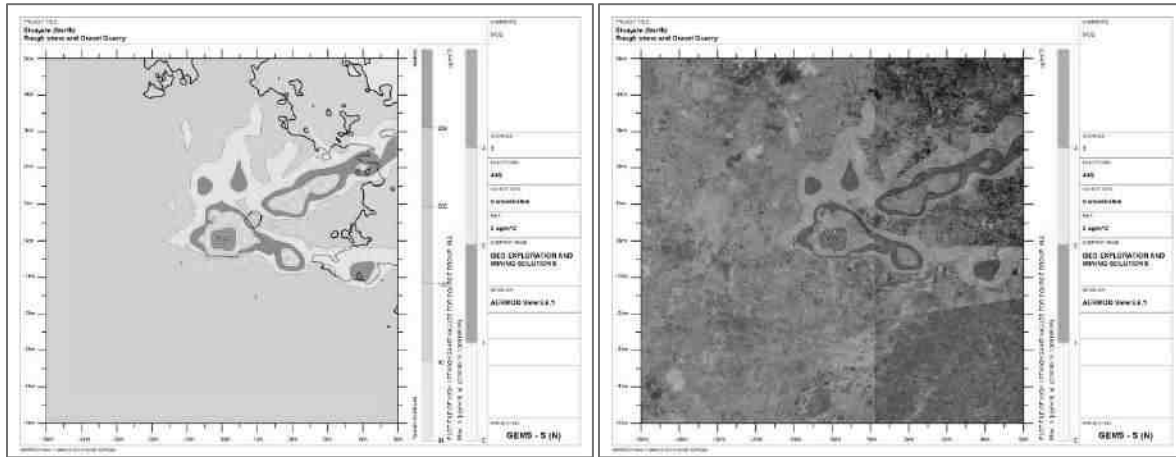
FIGURE 4.4: PREDICTED INCREMENTAL CONCENTRATION OF NOₓ
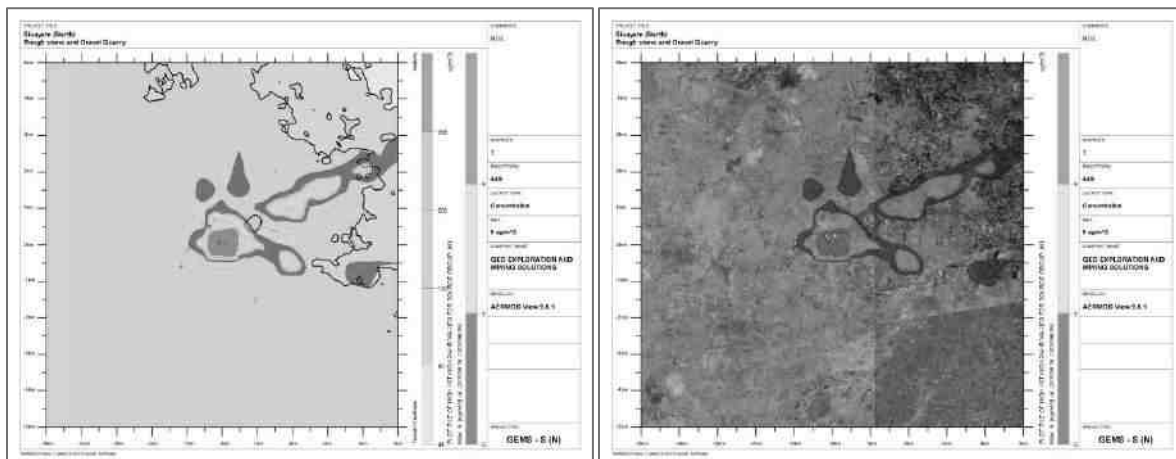
4.3.2.1 Model Results

The post project Resultant Concentrations of PM_{10}, $PM_{2.5}$, SO_2 & NO_X (GLC) is given in Table below:

TABLE 4.5: INCREMENTAL & RESULTANT GLC OF PM_{10}

Location	PM_{10} in µg/m³		
	Background	Incremental	Resultant
Core zone	47.1	16	63.1
NAAQS standards	100µg/m³		

TABLE 4.6: INCREMENTAL & RESULTANT GLC OF $PM_{2.5}$

Location	PM2.5 in µg/m³		
	Background	Incremental	Resultant
Core zone	22.95	9	31.95
NAAQS standards	100µg/m³		

TABLE 4.7: INCREMENTAL & RESULTANT GLC OF SO_2

Location	SO_2 in µg/m³		
	Background	Incremental	Resultant
Core zone	6.9	3.89	10.79
NAAQS standards	80 µg/m³		

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TABLE 4.8: INCREMENTAL & RESULTANT GLC OF NO$_X$

Location	NOx in µg/m^3		
	Background	Incremental	Resultant
Core zone	24.1	9.65	33.75
NAAQS standards	80 µg/m^3		

From the resultant of cumulative concentration i.e., Background + Incremental Concentration of pollutant in all the receptor locations without effective mitigation measures are still within the prescribed NAAQ limits of 100, 80 & 80 µg/m^3 for PM$_{10}$, SO$_2$ & NO$_X$ respectively. By adopting suitable mitigation measures, the pollutant levels in the atmosphere can be further being controlled.

4.3.4. Mitigation Measures

Drilling – To control dust at source, wet drilling will be practiced. Where there is a scarcity of water, suitably designed dust extractor will be provided for dry drilling along with dust hood at the mouth of the drill-hole collar.

Advantages of Wet Drilling:-

- In this system dust gets suppressed close to its formation. Dust suppression become very effective and the work environment will be improved from the point of occupational comfort and health.
- Due to dust free atmosphere, the life of engine, compressor etc., will be increased.
- The life of drill bit will be increased.
- The rate of penetration of drill will be increased.
- Due to the dust free atmosphere visibility will be improved resulting in safer working conditions.

Blasting –

- Establish time of blasting to suit the local conditions and water sprinkling on blasting face
- Avoid blasting i.e., when temperature inversion is likely to occur and strong wind blows towards residential areas
- Controlled blasting include Adoption of suitable explosive charge and short delay detonators, adequate stemming of holes at collar zone and restricting blasting to a particular time of the day i.e. at the time lunch hours, controlled charge per hole as well as charge per round of hole
- Before loading of Rough stone into the tippers water will be sprayed to eliminate the dust

Haul Road & Transportation –

- Water will be sprinkled on haul roads, Loading Points twice a day to avoid dust generation during transportation
- Transportation of material will be carried out during day time and material will be covered with taurpaulin
- The speed of tippers plying on the haul road will be limited below 20 km/hr to avoid generation of dust.
- Main source of gaseous pollution will be from vehicle used for transportation of mineral; therefore weekly maintenance of machines improves combustion process & makes reduction in the pollution.
- The un-metalled haul roads will be compacted weekly before being put into use.
- Over loading of tippers will be avoided to prevent spillage.
- It will be ensured that all transportation vehicles carry a valid PUC certificate.
- Grading of haul roads and service roads to clear accumulation of loose materials.

Green Belt –

- Planting of trees all along main mine haul road and regular grading of haul roads will be practiced to prevent the generation of dust due to movement of dumpers/trucks
- Green belt of adequate width will be developed around the project area

Occupational Health –

- Dust mask will be provided to the workers and their use will be strictly monitored
- Annual medical checkups, trainings and campaigns will be arranged to ensure awareness about importance of wearing dust masks among all mine workers & tipper drivers
- Ambient Air Quality Monitoring will be conducted six month once to assess effectiveness of mitigation measures proposed

4.4 NOISE ENVIRONMENT

Noise pollution is mainly due to operation like drilling & blasting and plying of trucks & HEMM. These activities will not cause any problem to the inhabitants of this area because there is no human settlement in close proximity to the project area. Noise modelling has been carried out considering blasting and compressor operation (drilling) and transportation activities.

Predictions have been carried out to compute the noise level at various distances around the working pit due to these major noise-generating sources.   Noise modelling has been carried out to assess the impact on surrounding ambient noise levels.

Basic phenomenon of the model is the geometric attenuation of sound. Noise at a point generates spherical waves, which are propagated outwards from the source through the air at a speed of 1,100 ft/sec, with the first wave making an ever-increasing sphere with time. As the wave spreads the intensity of noise diminishes as the fixed amount of energy is spread over an increasing surface area of the sphere. The assumption of the model is based on point source relationship i.e., for every doubling of the distance the noise levels are decreased by 6 dB (A).

For hemispherical sound wave propagation through homogeneous loss free medium, one can estimate noise levels at various locations at different sources using model based on first principle.

$$Lp_2 = Lp_1 - 20 \log (r_2/r_1) - Ae_{1, 2}$$

Where:

Lp_1 & Lp_2 are sound levels at points located at distances r_1 & r_2 from the source.

$Ae_{1, 2}$ is the excess attenuation due to environmental conditions. Combined effect of all sources can be determined at various locations by logarithmic addition.

$$Lp_{total} = 10 \log \{10^{(Lp1/10)} + 10^{(Lp2/10)} + 10^{(Lp3/10)} + \ldots\ldots\}$$

4.4.1 Anticipated Impact

Attenuation due to Green Belt has been taken to be 4.9 dB (A). The inputs required for the model are:

- Source data
- Receptor data
- Attenuation factor

Source data has been computed taking into account of all the machinery and activities used in the mining process. Same has been listed in Table 4-8.

TABLE 4.9: ACTIVITY AND NOISE LEVEL PRODUCED BY MACHINERY

Sl.No.	Machinery / Activity	Impact on Environment?	Noise Produced in dB(A) at 50 ft from source*
1	Blasting	Yes	94
2	Jack Hammer	Yes	88
3	Compressor	No	81
4	Excavator	No	85
5	Tipper	No	84
Total Noise Produced			95.8

*50 feet from source = 15.24 meters

Source: U.S. Department of Transportation (Federal Highway Administration) – Construction Noise Handbook

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The total noise to be produced by mining activity is calculated to be 95.8 dB (A). Generally most mining operations produce noise between 100-109 dB (A). We have considered equipment and operation noise levels (max) to be approx. 109 dB (A) for nose prediction modelling.

TABLE 4.10: PREDICTED NOISE INCREMENTAL VALUES

Location ID	N1	N2	N3	N4	N5	N6	N7	N8
Maximum Monitored Value (Day) dB(A)	54.7	55.1	54.8	54.3	53.7	43.1	55.0	47.2
Incremental Value dB(A)	66.1	64.5	63.2	62.0	50.6	66.1	64.5	63.2
Total Predicted Noise level dB(A)	66.4	65.0	63.8	62.7	55.4	66.1	65.0	63.3
NAAQ Standards	**Industrial**	**Day Time- 75 dB (A) & Night Time- 70 dB (A)**						
	Residential	**Day Time– 55 dB (A) & Night Time- 45 dB (A)**						

The incremental noise level is found within the range of 50.6 – 66.1 dB (A) in Core Zone and 63.2- 66.1 dB (A) in Buffer zone. The noise level at different receptors in buffer zone is lower due to the distance involved and other topographical features adding to the noise attenuation. The resultant Noise level due to monitored values and calculated values at the receptors are based on the mathematical formula considering attenuation due to Green Belt as 4.9 dB (A) the barrier effect. From the above table, it can be seen that the ambient noise levels at all the locations are within permissible limits of Industrial area (core zone) & Residential area (buffer zone) as per THE NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000 (The Principal Rules were published in the Gazette of India, vide S.O. 123(E), dated 14.2.2000 and subsequently amended vide S.O. 1046(E), dated 22.11.2000, S.O. 1088(E), dated 11.10.2002, S.O. 1569 (E), dated 19.09.2006 and S.O. 50 (E) dated 11.01.2010 under the Environment (Protection) Act, 1986.).

4.4.2 Mitigation measures for Control of Noise

The following noise mitigation measures are proposed for control of Noise
- Usage of sharp drill bits while drilling which will help in reducing noise;
- Secondary blasting will be totally avoided and hydraulic rock breaker are utilized for breaking boulders;
- Controlled blasting with proper spacing, burden, stemming and optimum charge/delay will reduce noise;
- The blasting will be carried out during favourable atmospheric condition and less human activity timings by using nonelectrical initiation system;
- Proper maintenance, oiling and greasing of machines will be done every week to reduce generation of noise;
- Provision of sound insulated chambers for the workers working on machines (HEMM) producing higher levels of noise;
- Silencers / mufflers will be installed in all machineries;
- Green Belt will be developed around the project areas and along the haul roads. The plantation minimizes propagation of noise;
- Personal Protective Equipment (PPE) like ear muffs/ear plugs will be provided to the operators of HEMM and persons working near HEMM and their use will be ensured though training and awareness.
- Regular medical check–up and proper training to personnel to create awareness about adverse noise level effects

4.4.3 Ground Vibrations

Ground vibrations due to mining activities in the project area are anticipated due to operation of Mining Machines like Excavators, drilling and blasting, transportation vehicles, etc. However, the major source of ground vibration from the proposed mine is blasting. The major impact of the ground vibrations is observed on the domestic houses located in the villages nearby the mine lease area. The kuchha houses are more prone to cracks and damage due to the vibrations induced by blasting whereas RCC framed structures can withstand more ground vibrations. Apart from this, the ground vibrations may develop a fear factor in the nearby settlements.

Another impact due to blasting activities is fly rocks. These may fall on the houses or agricultural fields nearby the mining lease area and may cause injury to persons or damage to the structures. Nearest habitation from the project area is located 450 m West in Kuzhanthai patti village. The ground vibrations due to the blasting in proposed mine are calculated using the empirical equation.

The empirical equation for assessment of peak particle velocity (PPV) is:

$$V = K \, [R/Q^{0.5}]^{\,-B}$$

Where –
V = peak particle velocity (mm/s)
K = site and rock factor constant
Q = maximum instantaneous charge (kg)
B = constant related to the rock and site (usually 1.6)
R = distance from charge (m)

FIGURE 4.5: GROUND VIBRATION PREDICTION
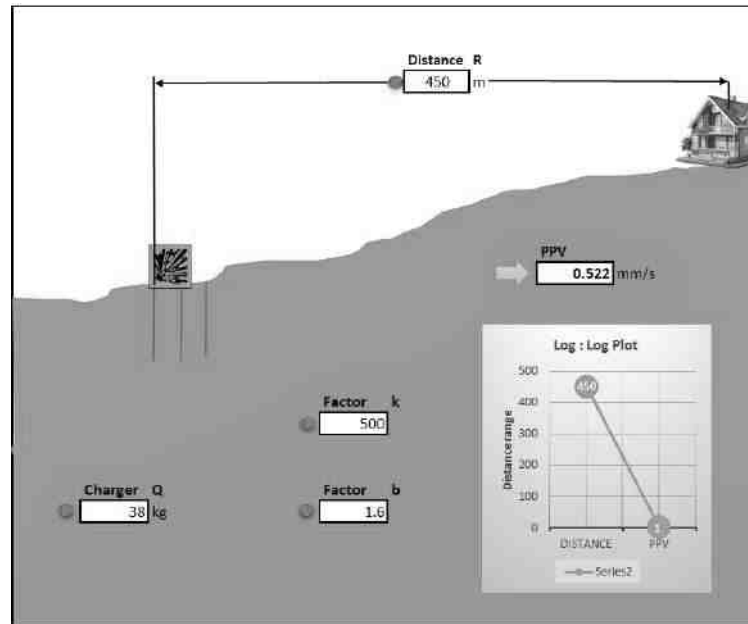
From the above graph, the charge per blast of 38kg is well below the Peak Particle Velocity of 8 mm/s as per Directorate General of Mines Safety for safe level criteria through Circular No. 7 dated 29/8/1997. It should be ensured that the explosives used for blasting at one blast should not exceed more than 100kg at any point of time. However, as per statutory requirement control measures will be adopted to avoid the impacts due to ground vibrations and fly rocks due to blasting.

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4.4.3.1 Mitigation measures for Control of Vibration

- The blasting operations in the mine are proposed to be carried out by jackhammer drilling and blasting using delay detonators, which reduces the ground vibrations;
- Proper quantity of explosive, suitable stemming materials and appropriate delay system should be adopted to avoid overcharging and for safe blasting;
- Adequate safe distance from blasting should be maintained as per DGMS guidelines;
- Blasting shelter should be provided as per DGMS guidelines;
- Blasting operations shall be carried out only during day time;
- The charge per delay shall be minimized and preferably more number of delays will be used per blasts;
- During blasting, other activities in the immediate vicinity shall be temporarily stopped;
- Drilling parameters like depth, diameter and spacing will be properly designed to give proper blast;
- A fully trained explosives blast man (Mining Mate, Mines Foreman, 2nd Class Mines Manager/ 1st Class Mines Manager) will be appointed.
- A set of shot firing rules will be drawn up and blasting shall commence outlining the detailed operating procedures that will be followed to ensure that shot firing operations on site take place without endangering the workforce or public.
- Sufficient angular stemming material will be used to confine the explosive force and minimise environmental disturbance caused by venting / misfire.
- The detonators will be connected in a predetermined sequence to ensure that only one charge is detonated at any one time and a NONEL or similar type initiation system will be used.
- The detonation delay sequence shall be designed so as to ensure that firing of the holes is in the direction of free faces so as to minimise vibration effects.
- Appropriate blasting techniques shall be adopted such that the predicted peak particle velocity shall not exceed 8 Hz.
- Vibration monitoring should be carried out every 6 months to check the efficacy of blasting practices.

4.5   ECOLOGY AND BIODIVERSITY

4.5.1 Impact on Ecology and Biodiversity

The impact on biodiversity is difficult to quantify because of its diverse and dynamic characteristics, mining activities generally result in the deforestation, land degradation, water, air and noise pollution which directly or indirectly affect the faunal and floral status of the project area. However, occurrence and magnitude of these impacts are entirely dependent upon the project location, mode of operation and technology involved. Impact prediction is the main footstep in impact evaluation and identifies project actions that are likely to bring significant changes in the project environment. The present study was carried out to predict the likely impacts of the proposed project at Nadanthai Norht village and the surrounding environment with special reference to biological attributes covering habitats/ecosystems and associated biodiversity.

The proposed mining activities include removal of some scattered bushes and other thorny species. Although impacts on key habitat elements will occur on a local scale, but on a regional scale they would not be critical for the life cycle needs of the species observed or expected. Moreover, during conceptual stage, the mined-out areas on the top bench will be re-vegetated by planting local /native species and lower benches will be converted into rainwater harvesting structure following completion of mining activities, which will replace habitat resources for fauna species in this locality over a longer time. Existing roads will be used; new roads will not be constructed to reduce impact on flora.

Wild life is not commonly found in the project area and its immediate environs because of lack of vegetal cover and surface water. Except few domestic animals, reptiles, hares and some common birds are observed in the study area.

I.   None of the plants will be cut during operational phase of the mine.

II. There shall be negligible air emissions or effluents from the project site. During loading the truck, dust generation will be likely. This shall be a temporary effect and not anticipated to affect the surrounding vegetation significantly.

III. Most of the land in the buffer area is undulating terrain with crop lands, grass patches and small shrubs. Hence, there will be no effect on flora of the region.

4.5.2 Common Mitigation Measures for Proposed Project

Keeping all this in mind the mitigations have been suggested under environmental management plan. With the understanding of the role of plant species as bio-filter to control air pollution, appropriate plant species (mainly tree species) have been suggested conceding the area/site requirements and needed performance of specific species. The details of year wise proposed plantiation program are given in Table 4.13.

The main objective of the green belt is to provide a barrier between the source of pollution and the surrounding areas.

In order to compensate the loss of vegetation cover, it is suggested to carry out afforestation program mainly in proposed areas falls in the cluster earmarked for plantation program as per Approved Mining Plan in different phases. This habitat improvement program would ensure the faunal species to re-colonize and improve the abundance status in the core zone.

The objectives of the green belt cover will cover the following:

- Noise abatement
- Ecological restoration
- Aesthetic, biological and visual improvement of area due to improved vegetative and plantations cover.

4.5.2.1. Species Recommendation for Plantation granted in the district

Following points have been considered while recommending the species for plantation:

- Natural growth of existing species and survival rate of various species.
- Suitability of a particular plant species for a particular type of area.
- Creating of biodiversity.
- Fast growing, thick canopy copy, perennial and evergreen large leaf area.
- Efficient in absorbing pollutants without major effects of natural growth.
- The following species may be considering primary for plantation best suited for the prevailing climate condition in the area.

TABLE 4.13: RECOMMENDED SPECIES FOR GREENBELT DEVELOPMENT PLAN

SI.No	Name of the plant (Botanical)	Family Name	Common Name	Habit
1	*Azadirachta indica*	Meliaceae	Neem, Vembu	Tree
2	*Albiziafalcatoria*	Fabaceae	Tamarind, Puliyamaram	Tree
3	*Polyalthialongifolia*	Annonaceae	Kattumaram	Tree
4	*Borassus Flabellifer*	Arecaceae	Palmyra Palm	Tree

The Safety zone, Approach road and village road has been identified to be utilized for subsequent Afforestation. However, the afforestation should always be carried out in a systematic and scientific manner. Regional trees like Neem, Pongamia, Pinnata will be planted along the Lease boundary and avenue plantation will be carried out in respective proposed projects. The rate of survival expected to be 80% in this area. Afforestation Plan is given in Table No.4.13 and budget of green belt development plan are given in Table No.4.14.

TABLE 4.14: GREENBELT DEVELOPMENT PLAN

Year	No. of trees proposed to be planted	Survival %	Area to be covered	Name of the species	No. of trees expected to be grown
I	1680	80%	Safety zone, Approach road and village road	Neem, Pongamia Pinnata,etc.,	1400

TABLE 4.15: BUDGET FOR GREENBELT DEVELOPMENT PLAN

Activity	Year					Cost	Total Cost
	I	II	III	IV	V		
No.of Plantation in inside of the Project site	480	-	-	-	-	@ 200 Rs/ Saplings	Rs 96,000
No.of Plantation in outside of the Project site	1200	-	-	-	-	@ 300 Rs/ Saplings	Rs.3,60,000
Renovation of Wire Fencing (692meters)	2,07,600	-	-	-	-	@ 300Rs per meter	Rs.2,07,600
Renovation of Garland Drain (650 meters)	1,95,000				-	@ 300Rs per meter	Rs.1,95,000
Total							**Rs. 8,58,600**

After complete extraction of mineral, the excavated pits will be allowed to collect rainwater and seepage water to serve as a reservoir to charge the nearby wells. Fish culture will also be attempted. A bund will be constructed around the pits. In order to minimize the impact of mining on the vegetation outside the mine lease area, it is recommended that adequate protection measures must be implemented. As mining involves movement of vehicles and increased anthropogenic activities, some of the areas can be fenced by involving local people and educating them about increased benefits of such activities.

4.5.3. Anticipated Impact on Fauna

- There is no Wildlife Sanctuary and Biosphere Reserve within 10 km radius of the project site.
- No rare, endemic & endangered species are reported in the buffer zone. However, during the course of mining, the management will practice scientific method of mining with proper Environmental Management Plan including pollution control measures especially for air and noise, to avoid any adverse impact on the surrounding wildlife.
- Fencing around all the proposed mine lease areas will be constructed to restrict the entry of stray animals
- Green belt development will be carried out which will help in minimizing adverse impact on the flora found in the area.

4.5.3.1. Measures for protection and conservation of wildlife species

- Undertaking mitigative measures for conducive environment to the flora and fauna in consultation with Forest Department.
- Dust suppression system will be installed within mine and periphery of mine for all proposed projects
- Plantation around mine area will help in creating habitats for small faunal species and to create better environment for various fauna. Creating and developing awareness for nature and wildlife in the adjoining villages.

4.5.3.2. Mitigation Measures

- All the preventive measures will be taken for growth & development of fauna.
- Creating and development awareness for nature and wildlife in the adjoin villages.

▪ The workers shall be trained to not harm any wildlife, should it come near the project site. No work shall be carried out after 6.00 pm.

4.5.4. Impact on Aquatic Biodiversity

Mining activities will not disturb the existing aquatic ecology as there is no effluent discharge proposed from the Rough stone quarry. There is no natural perennial surface water body within the mine lease area. Hence, aquatic biodiversity is not observed in the mine lease area.

4.5.5. Impact Assessment on Biological Environment

A detail of impact and assessments was mentioned in Table No 4.15.

TABLE 4.16: ECOLOGICAL IMPACT ASSESSMENTS

Sl.No	Attributes	Assessment
1	Proximity to national park/wildlife sanctuary/reserve forest /mangroves/ coastline/estuary/sea	There is no 500m Radius from lease boundary.
2	Proposed mining project impact surface water quality that also provide water to wildlife	'NO 'scheduled or threatened wildlife animal sighted regularly core in core area.
3	Located near an area populated by rare or endangered species	NO endangered, critically endangered, vulnerable species sighted in core mining lease area.
4	Proposed project restricts access to waterholes for wildlife	'NO'
5	Project likely to affect migration routes	'NO 'migration route observed during monitoring period.
6	Proposed mining project increase siltation that would affect nearby biodiversity area.	Surface runoff management such as garland drains is proposed to be constructed, so there will be no siltation nearby mining area.
7	Risk of fall/slip or cause death to wild animals due to project activities	'NO'
8	Activities of the project affects the breeding/nesting sites of birds and animals	No breeding and nesting site was identified in mining lease site. The fauna sighted mostly migrated from buffer area.
9	Mining project effect the forest-based livelihood/ any specific forest product on which local livelihood depended	'NO'
10	The project release effluents into a water body that also supplies water to a wildlife	No water body near to core zone so chances of water become polluted is low.
11	The project likely to affect wetlands, Fish breeding grounds, marine ecology	'NO'. Wetland was not present in near core Mining lease area. No breeding and nesting ground present in core mining area.
12	Project likely to affect flora of an area, which have medicinal value	'NO'
13	Forestland is to be diverted, has carbon high sequestration	'NO 'There was no forest land diverted.

TABLE 4.17: ANTICIPATED IMPACT OF ECOLOGY AND BIODIVERSITY

Sl. No	Aspect Description	Likely Impacts on Ecology and Biodiversity (EB)	Impact Consequence - Probability Description / Justification	Significance	Mitigation Measures
Pre-Mining Phase					

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1	Uprooting of vegetation of lease area	Site specific loss of common floral diversity (Direct impact)	Site possesses common floral (not trees) species. Clearance of these species will not result in loss of flora	Less severe	No immediate action required. However, Greenbelt /plantation will be developed in project site and in periphery of the project boundary, which will improve flora and fauna diversity of the project area.
		Site specific loss of associated faunal diversity (Partial impact)	Site supports only common species, which use wide variety of habitats of the buffer zone reserve forest area. So, there is no threat of faunal diversity.		
		-Loss of Habitat (Direct impact)	Site does not form Unique / critical habitat structure for unique flora or fauna.		
Mining phase					
2	Excavation of mineral using machine and labours, Transportation activities will generate noise.	Site-specific disturbance to normal faunal movements at the site due to noise. (Partial impact)	Site does not form unique / critical habitat structure for unique flora or fauna.	Less severe	Mining activity should not be operated after 5PM. Excavation of dump and transportation work should stop before 7PM.
3	Vehicular Movement for transportation of materials will result in generation of dust (SPM) due to haul roads and emission of SO2,NO2,CO etc.	Impact on surrounding agriculture and associated fauna due to deposition of dust and Emission of CO. (Indirect impact)	Impact is less as the agricultural land far from core area.	Less severe	All vehicles will be certified for appropriate Emission levels. More plantation has been suggested Upgrade the vehicles with alternative fuel such biodiesel, methanol and biofuel around the mining area.

4.6   SOCIO ECONOMIC

4.6.1 Anticipated Impact from Proposed Project

- Dust generation from mining activity can have negative impact on the health of the workers and people in the nearby area.

- Approach roads can be damaged by the movement of tippers

- Increase in Employment opportunities both direct and indirect thereby increasing economic status of people of the region

4.6.2 Common Mitigation Measures for Proposed Project

- Good maintenance practices will be adopted for all machinery and equipment, which will help to avert potential noise problems.

- Green belt will be developed in and around the project site as per Central Pollution Control Board (CPCB) guidelines

- Air pollution control measure will be taken to minimize the environmental impact within the core zone.

- For the safety of workers, personal protective appliances like hand gloves, helmets, safety shoes, goggles, aprons, nose masks and ear protecting devices will be provided as per mines act and rules.

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- Benefit to the State and the Central governments through financial revenues by way of royalty, tax, duties, etc., from this project directly and indirectly.

- From above details, the quarry operations will have highly beneficial positive impact in the area.

4.7   OCCUPATIONAL HEALTH AND SAFETY

Occupational health and safety hazards occur during the operational phase of mining and primarily include the following:

- Respiratory hazards
- Noise
- Physical hazards
- Explosive storage and handling

4.7.1 Respiratory Hazards

Long-term exposure to silica dust may cause silicosis the following measures are proposed:

- Cabins of excavators and tippers will be enclosed with AC and sound proof
- Use of personal dust masks will be made compulsory

4.7.2 Noise

Workers are likely to get exposed to excessive noise levels during mining activities. The following measures are proposed for implementation

- No employee will be exposed to a noise level greater than 85 dB(A) for a duration of more than 8 hours per day without hearing protection
- The use of hearing protection will be enforced actively when the equivalent sound level over 8 hours reaches 85 dB(A), the peak sound levels reach 140 dB(C), or the average maximum sound level reaches 110 dB(A)
- Ear muffs provided will be capable of reducing sound levels at the ear to at least 85 dB(A)
- Periodic medical hearing checks will be performed on workers exposed to high noise levels

4.7.3 Physical Hazards

The following measures are proposed for control of physical hazards

- Specific personnel training on work-site safety management will be taken up;
- Work site assessment will be done by rock scaling of each surface exposed to workers to prevent accidental rock falling and / or landslide, especially after blasting activities;
- Natural barriers, temporary railing, or specific danger signals will be provided along rock benches or other pit areas where work is performed at heights more than 2m from ground level;
- Maintenance of yards, roads and footpaths, providing sufficient water drainage and preventing slippery surfaces with an all-weather surface, such as coarse gravel will be taken up

4.7.4 Occupational Health Survey

All the persons will undergo pre-employment and periodic medical examination. Employees will be monitored for occupational diseases by conducting the following tests

- General physical tests
- Audiometric tests
- Full chest, X-ray, Lung function tests, Spirometric tests
- Periodic medical examination – yearly
- Lung function test – yearly, those who are exposed to dust
- Eye test

Essential medicines will be provided at the site. The medicines and other test facilities will be provided at free of cost. The first aid box will be made available at the mine for immediate treatment. First aid training will be imparted to the selected employees regularly. The lists of first aid trained members shall be displayed at strategic places.

4.8   MINE WASTE MANAGEMENT

No waste is anticipated from any of the proposed quarry.

4.9   MINE CLOSURE

Mine closure plan is the most important environmental requirement in mining projects. The mine closure plan should cover technical, environmental, social, legal and financial aspects dealing with progressive and post closure activities. The closure operation is a continuous series of activities starting from the decommissioning of the project. Therefore, progressive mine closure plan should be specifically dealt with in the mining plan and is to be reviewed along with mining plan. As progressive mine closure is a continuous series of activities, it is obvious that the proposals of scientific mining have included most of the activities to be included in the closure plan. While formulating the closure objectives for the site, it is important to consider the existing or the pre-mining land use of the site; and how the operation will affect this activity.

The primary aim is to ensure that the following broad objectives along with the abandonment of the mine can be successfully achieved:

- To create a productive and sustainable after-use for the site, acceptable to mine owners, regulatory agencies, and the public
- To protect public health and safety of the surrounding habitation
- To minimize environmental damage
- To conserve valuable attributes and aesthetics
- To overcome adverse socio-economic impacts.

4.9.1 Mine Closure Criteria

The criteria involved in mine closure are discussed below:

4.9.1.1 Physical Stability

All anthropogenic structures, which include mine workings, buildings, rest shelters etc., remaining after mine decommissioning should be physically stable. They should present no hazard to public health and safety as a result of failure or physical deterioration and they should continue to perform the functions for which they were designed. The design periods and factors of safety proposed should take full account of extreme events such as floods, hurricane, winds or earthquakes, etc. and other natural perpetual forces like erosion, etc.,

4.9.1.2 Chemical Stability

The solid wastes on the mine site should be chemically stable. This means that the consequences of chemical changes or conditions leading to leaching of metals, salts or organic compounds should not endanger public health and safety nor result in the deterioration of environmental attributes. If the pollutant discharge likely to cause adverse impacts is predicted in advance, appropriate mitigation measures like settling of suspended solids or passive treatment to improve water quality as well as quantity, etc., could be planned. Monitoring should demonstrate that there is no adverse effect of pollutant concentrations exceeding the statutory limits for the water, soil and air qualities in the area around the closed mine.

4.9.1.3 Biological Stability

The stability of the surrounding environment is primarily dependent upon the physical and chemical characteristics of the site, whereas the biological stability of the mine site itself is closely related to rehabilitation and final land use.

Nevertheless, biological stability can significantly influence physical or chemical stability by stabilizing soil cover, prevention of erosion/wash off, leaching, etc.,

A vegetation cover over the disturbed site is usually one of the main objectives of the rehabilitation programme, as vegetation cover is the best long-term method of stabilizing the site. When the major earthwork components of the rehabilitation programme have been completed, the process of establishing a stable vegetation community begins. For re-vegetation, management of soil nutrient levels is an important consideration. Additions of nutrients are useful under three situations.

- Where the nutrient level of spread topsoil is lower than material in-situ e.g. for development of social forestry
- Where it is intended to grow plants with a higher nutrient requirement than those occurring naturally e.g. planning for agriculture
- Where it is desirable to get a quick growth response from the native flora during those times when moisture is not a limiting factor e.g. development of green barriers

The Mine closure plan should be as per the approved mine plan. The mine closure is a part of approved mine plan and activities of closure shall be carried out as per the process described in mine closure plan.

5.   ANALYSIS OF ALTERNATIVES (TECHNOLOGY AND SITE)

5.1   INTRODUCTION

Consideration of alternatives to a project proposal is a requirement of EIA process. During the scoping process, alternatives to a proposal can be considered or refined, either directly or by reference to the key issues identified. A comparison of alternatives help to determine the best method of achieving the project objectives with minimum environmental impacts or indicates the most environmentally friendly and cost effective options.

5.2   FACTORS BEHIND THE SELECTION OF PROJECT SITE

Tvl Navamani Mines Pvt Ltd Rough Stone and Gravel Cluster Quarry Project at Sivayam (North) Village is a mining project for excavation of Rough stone and Gravel, which is site specific. The proposed mining lease area has following advantages:-

- The mineral deposit occurs in a non-forest area.
- There is no habitation within the project area; hence no R & R issues exist.
- There are no river, stream, nallah and water bodies in the applied mine lease area.
- Availability of skilled, semi-skilled and unskilled workers in this region.
- All the basic amenities such as medical, firefighting, education, transportation, communication and infrastructural facilities are well connected and accessible.
- The mining operations will not intersect the ground water level. Hence, no impact on ground water environment.
- Study area falls in seismic zone – II, there is no major history of landslides, earthquake, subsidence etc., recorded in the past history

5.3   ANALYSIS OF ALTERNATIVE SITE

No alternatives are suggested as the mine site is mineral specific

5.4   FACTORS BEHIND SELECTION OF PROPOSED TECHNOLOGY

Mechanized open cast mining operation with drilling and blasting method will be used to extract Rough Stone and Gravel in the area. The applied mining lease area has following advantages –

- As the mineral deposition is homogeneous and batholith formation, therefore opencast method of working out deposit is preferred over underground method
- The material will be loaded after sprinkling with water with the help of excavators into dumpers / trippers and transported to the needy customers
- Blasting and availability of drills along with controlled blasting technology gives desired fragmentation so that the mineral is handled safely and used without secondary blasting
- Semi-skilled labours fit for quarrying operations are easily available around the nearby villages

5.5   ANALYSIS OF ALTERNATIVE TECHNOLOGY

Open cast mechanized method has been selected for this project. This technology is having least gestation period, economically viable, safest and less labour intensive. The method has inbuilt flexibility for increasing or decreasing the production as per market condition.

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6.   ENVIRONMENTAL MONITORING PROGRAMME

6.0   GENERAL

The monitoring and evaluation of environmental parameters indicates potential changes occurring in the environment, which paves way for implementation of rectifying measures wherever required to maintain the status of the natural environment. Evaluation is also a very effective tool to judge the effectiveness or deficiency of the measures adopted and provides insight for future corrections.

The main objective of environmental monitoring is to ensure that the obtained results in respect of environmental attributes and prevailing conditions during operation stage are in conformity with the prediction during the planning stage. In case of substantial deviation from the earlier prediction of results, this forms as base data to identify the cause and suggest remedial measures. Environmental monitoring is mandatory to meet compliance of statutory provisions under the Environment (Protection) Act, 1986, relevant conditions regarding monitoring covered under EC orders issued by the SEIAA as well as the conditions set forth under the order issued by Tamil Nadu Pollution Control Board while granting CTO.

6.1   METHODOLOGY OF MONITORING MECHANISM

Implementation of EMP and periodic monitoring will be carried out by Project Proponent. A comprehensive monitoring mechanism has been devised for monitoring of impacts due to proposed project; Environmental protection measures like dust suppression, control of noise and blast vibrations, maintenance of machinery and vehicles, housekeeping in the mine premises, plantation, implementation of Environmental Management Plan and environmental clearance conditions will be monitored by the Mine Management. On the other hand, implementation of area level protection measures like green belt development, environmental quality monitoring etc., are taken up by a senior executive who reports Mine Management.

An Environment monitoring cell (EMC) will be constituted to monitor the implementation of EMP and other environmental protection measures.

The responsibilities of this cell will be:

- Implementation of pollution control measures
- Monitoring programme implementation
- Post-plantation care
- To check the efficiency of pollution control measures taken
- Any other activity as may be related to environment
- Seeking expert's advice when needed

The environmental monitoring cell will co-ordinate all monitoring programs at site and data thus generated will be regularly furnished to the State regulatory agencies as compliance status reports.

The sampling and analysis report of the monitored environmental attributes will be submitted to the Tamil Nadu Pollution Control Board (TNPCB) at a frequency of half-yearly and yearly. The half-yearly reports are submitted to Ministry of Environment and Forest, Regional Office and SEIAA as well.

The sampling and analysis of the environmental attributes will be as per the guidelines of Central Pollution Control Board (CPCB)/Ministry of Environment, Forest and Climate Change (MoEF & CC).

FIGURE 6.1: ENVIRONMENTAL MONITORING CELL FOR INDIVIDUAL LEASES
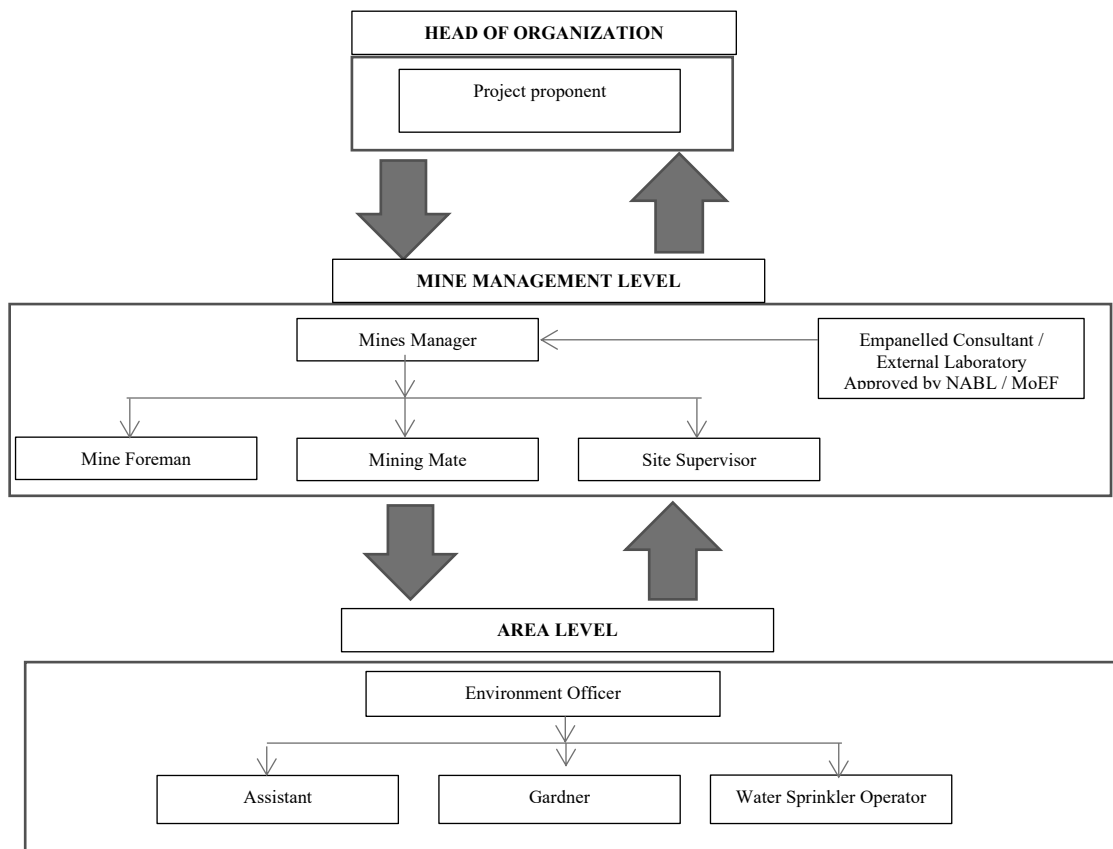
6.2   IMPLEMENTATION SCHEDULE OF MITIGATION MEASURES

The mitigation measures proposed in Chapter-4 will be implemented so as to reduce the impact on the environment due to the operations of the proposed project. Implementation schedule of mitigation measures is given in Table 6.1.

TABLE 6.1 IMPLEMENTATION SCHEDULE

Sl No.	Recommendations	Time Period	Schedule
1	Land Environment Control Measures	Before commissioning of the project	Immediately after the commencement of project
2	Soil Quality Control Measures	Before commissioning of the project	Immediately after the commencement of project
3	Water Pollution Control Measures	Before commissioning of the project and along with mining operation	Immediately and as project progress
4	Air Pollution Control Measures	Before commissioning of the project and along with mining operation	Immediately and as project progress
5	Noise Pollution Control Measures	Before commissioning of the project and along with mining operation	Immediately and as project progress
6	Ecological Environment	Phase wise implementation every year along with mine operations	Immediately and as project progress

6.3   MONITORING SCHEDULE AND FREQUENCY

Monitoring shall confirm that commitments are being met. This may take the form of direct measurement and recording of quantitative information, such as amounts and concentrations of discharges, emissions and wastes, for measurement against statutory standards. Monitoring may include socio-economic interaction, through local liaison activities or even assessment of complaints.

The environmental monitoring will be conducted in the mine operations as follows:

- Air quality;
- Water and wastewater quality;
- Noise levels;
- Soil Quality; and
- Greenbelt Development

The details of monitoring is detailed in Table 6.2

TABLE 6.2: MONITORING SCHEDULE FOR INDIVIDUAL LEASES

S. No.	Environment Attributes	Location	Monitoring		Parameters
			Duration	Frequency	
1	Air Quality	2 Locations (1 Core & 1 Buffer)	24 hours	Once in 6 months	Fugitive Dust, $PM_{2.5}$, PM_{10}, SO_2 and NO_x.
2	Meteorology	At mine site before start of Air Quality Monitoring & IMD Secondary Data	Hourly / Daily	Continuous online monitoring	Wind speed, Wind direction, Temperature, Relative humidity and Rainfall
3	Water Quality Monitoring	2 Locations (1SW & 1 GW)	-	Once in 6 months	Parameters specified under IS:10500, 1993 & CPCB Norms
4	Hydrology	Water level in open wells in buffer zone around 1 km at specific wells	-	Once in 6 months	Depth in bgl
5	Noise	2 Locations (1 Core & 1 Buffer)	Hourly – 1 Day	Once in 6 months	Leq, Lmax, Lmin, Leq Day & Leq Night
6	Vibration	At the nearest habitation (in case of reporting)	–	During blasting Operation	Peak Particle Velocity
7	Soil	2 Locations (1 Core & 1 Buffer)	–	Once in six months	Physical and Chemical Characteristics
8	Greenbelt	Within the Project Area	Daily	Monthly	Maintenance

Source: Guidance of manual for mining of minerals, February 2010

6.4   BUDGETARY PROVISION FOR EMP

The cost in respect of monitoring of environmental attributes, parameter to be monitored, sampling/monitoring locations with frequency and cost provision against each proposal is shown in Table 6.3. Monitoring work will be outsourced to external laboratory approved by NABL / MoEF.

The proposed capital cost for Environmental Monitoring Programme is Rs 76,000/- and the recurring cost is Rs 76,000/- per annum for each Proposed Project.

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TABLE 6.3 ENVIRONMENT MONITORING BUDGET

Sl.No.	Parameter	Capital Cost	Recurring Cost per annum
1	Air Quality		
2	Meteorology		
3	Water Quality		
4	Hydrology	Rs. 76,000/-	Rs. 76,000/-
5	Soil Quality		
6	Noise Quality		
7	Vibration Study		
Total		**Rs 76,000/-**	**Rs 76,000/-**

Source: Approved Mining Plan

6.5   REPORTING SCHEDULES OF MONITORED DATA

The monitored data on air quality, water quality, noise levels and other environmental attributes will be periodically examined by the Cluster Mine Management Coordinator and Respective Head of Organization for taking necessary corrective measures. The monitoring data will be submitted to Tamil Nadu State Pollution Control Board in the Compliance to CTO Conditions & environmental audit statements every year to MoEF & CC and Half-Yearly Compliance Monitoring Reports to MoEF & CC Regional Office and SEIAA.

Periodical reports to be submitted to:-

- MoEF & CC – Half yearly status report
- TNPCB - Half yearly status report
- Department of Geology and Mining: quarterly, half yearly annual reports

Besides the Mines Manager/Agent will submit the periodical reports to –

- Director of mines safety,
- Labour enforcement officer,
- Controller of explosives as per the norms stipulated by the department.

7. ADDITIONAL STUDIES

7.0 GENERAL

The following Additional Studies were done as per items identified by project proponent and items identified by regulatory authority. And items identified by public and other stakeholders will be incorporated after Public Hearing.

- Public Consultation
- Risk Assessment
- Disaster Management Plan
- Cumulative Impact Study

7.1. PUBLIC CONSULTATION

Application to The Member Secretary of the Tamil Nadu Pollution Control Board (TNPCB) to conduct Public Hearing in a systematic, time bound and transparent manner ensuring widest possible public participation at the project site or in its close proximity in the District is submitted along with this Draft EIA / EMP Report and the outcome of public hearing proceedings will be detailed in the Final EIA/EMP Report.

7.2 RISK ASSESSMENT

The methodology for the risk assessment has been based on the specific risk assessment guidance issued by the Directorate General of Mine Safety (DGMS), Dhanbad, vide Circular No.13 of 2002, dated 31st December, 2002. The DGMS risk assessment process is intended to identify existing and probable hazards in the work environment and all operations and assess the risk levels of those hazards in order to prioritize those that need immediate attention. Further, mechanisms responsible for these hazards are identified and their control measures, set to timetable are recorded along with pinpointed responsibilities.

The whole quarry operation will be carried out under the direction of a Qualified Competent Mine Manager holding certificate of competency to manage a metalliferous mine granted by the DGMS, Dhanbad. Risk Assessment is all about prevention of accidents and to take necessary steps to prevent it from happening.

Factors of risks involved due to human induced activities in connection with this proposed mining & allied activities with detailed analysis of causes and control measures for the mine is given in below Table 7.1.

TABLE 7.1 RISK ASSESSMENT & CONTROL MEASURES

S. No	Risk factors	Causes of risk	Control measures
1	Accidents due to explosives and heavy mining machineries	Improper handling and unsafe working practice	- All safety precautions and provisions of Mine Act, 1952, Metalliferous Mines Regulation, 1961 and Mines Rules, 1955 will be strictly followed during all mining operations; - Workers will be sent to the Training in the nearby Group Vocational Training Centre - Entry of unauthorized persons will be prohibited; - Fire-fighting and first-aid provisions in the mine office complex and mining area; - Provisions of all the safety appliances such as safety boot, helmets, goggles etc. will be made available to the employees and regular check for their use - Working of quarry, as per approved plans and regularly updating the mine plans;

			•	Cleaning of mine faces on daily basis shall be daily done in order to avoid any overhang or undercut;
			•	Handling of explosives, charging and firing shall be carried out by competent statutory persons only under the supervision of a Mine Manager;
			•	Maintenance and testing of all mining equipment as per manufacturer's guidelines.
2	Drilling	Improper and unsafe practices Due to high pressure of compressed air, hoses may burst Drill Rod may break	•	Safe operating procedure established for drilling (SOP) will be strictly followed.
			•	Only trained operators will be deployed.
			•	No drilling shall be commenced in an area where shots have been fired until the blaster/blasting foreman has made a thorough Examination of all places,
			•	Drilling shall not be carried on simultaneously on the benches at places directly one above the other.
			•	Periodical preventive maintenance and replacement of worn out accessories in the compressor and drill equipment as per operator manual.
			•	Drills unit shall be provided with wet drilling to ensure efficient working.
			•	Operator shall regularly use all the personal protective equipment.
4	Blasting	Fly rock, ground vibration, Noise and dust. Improper charging, stemming & Blasting/ fining of blast holes Vibration due to movement of vehicles	•	Restrict maximum charge per delay as per regulations and by optimum blast hole pattern, vibrations will be controlled within the permissible limit and blasting can be conducted safely.
			•	SOP for Charging, Stemming & Blasting/Firing of Blast Holes will be followed by blasting crew during initial stage of operation
			•	Shots are fired during designated timings only.
			•	All holes charged on any one day shall be fired on the same day.
			•	The danger zone will be distinctly demarcated (by means of red flags)
5	Transportation	Potential hazards and unsafe workings contributing to accident and injuries Overloading of material While reversal & overtaking of vehicle Operator of truck leaving his cabin when it is loaded.	•	Before commencing work, drivers personally check the dumper/truck/tipper for oil(s), fuel and water levels, tyre inflation, general cleanliness and inspect the brakes, steering system, warning devices including automatically operated audio visual reversing alarm, rear view mirrors, side indicator lights etc., are in good condition.
			•	Unauthorized person will not be allowed to operate or ride on the vehicle
			•	Loading according to the vehicle capacity
			•	Periodical maintenance of vehicles as per operator manual

| 6 | Natural calamities | Unexpected happenings | ▪ Escape Routes will be provided to prevent inundation of storm water
▪ Fire Extinguishers & Sand Buckets in the designated areas |
| 7 | Failure of Mine Benches and Pit Slope | Slope geometry, Geological structure | ▪ Ultimate or over all pit slope shall be below 60° and each bench height shall be 5m height. |

Source:

7.3   DISASTER MANAGEMENT PLAN

Natural disasters like Earthquake, Landslides have not been recorded in the past history as the terrain is categorized under seismic zone III. The area is far away from the sea hence the disaster due to heavy floods and tsunamis are not anticipated

The Disaster Management Plan is aimed to ensure safety of life, protection of environment, protection of installation, restoration of production and salvage operations in this same order of priorities.

The objective of the Disaster Management Plan is to make use of the combined resources of the mine and the outside services to achieve the following:

▪ Rescue and medical treatment of casualties;
▪ Safeguard other people;
▪ Minimize damage to property and the environment;
▪ Initially contain and ultimately bring the incident under control;
▪ Secure the safe rehabilitation of affected area; and
▪ Preserve relevant records and equipment for the subsequent inquiry into the cause and circumstances of the emergency

In case a disaster takes place, despite preventive actions, disaster management will have to be done in line with the descriptions below. There is an organization proposed for dealing with the emergency situations and the coordination among key personnel and their team has been shown in Fig 7.1.
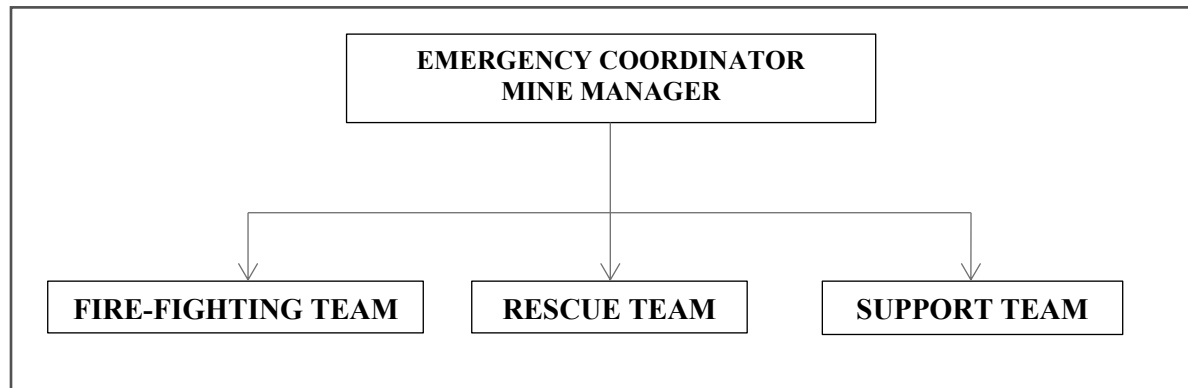
FIGURE 7.1: DISASTER MANAGEMENT TEAM LAYOUT

The emergency organization shall be headed by emergency coordinator who will be qualified competent mine manager. In his absence senior most people available at the mine shall be emergency coordinator till arrival of mine manager. There would be three teams for taking care of emergency situations – Fire-Fighting Team, Rescue Team and Support Team. The proposed composition of the teams is given in Table 7.2.

TABLE 7.2: PROPOSED TEAMS TO DEAL WITH EMERGENCY SITUATION

DESIGNATION	QUALIFICATION
FIRE-FIGHTING TEAM	
Team Leader/ Emergency Coordinator (EC)	Mines Manager
Team Member	Mines Foreman
Team Member	Mining Mate
RESCUE TEAM	
Team Leader/ Emergency Coordinator (EC)	Mines Manager
Team Member/ Incident Controller (IC)	Environment Officer
Team Member	Mining Foreman
SUPPORT TEAM	
Team Leader/ Emergency Coordinator (EC)	Mines Manager
Assistant Team Leader	Environment Officer
Team Member	Mining Mate
Security Team Leader/ Emergency Security Controller	Mines Foreman

Once the mine becomes operational, the above table along with names of personnel will be prepared and made easily available to workers. A mobile communication network and wireless shall connect Mine Emergency Control Room (MECR) to control various departments of the mine, fire station and neighbouring industrial units/mines.

Roles and responsibilities of emergency team –

(a) Emergency coordinator (EC)

The emergency coordinator shall assume absolute control of site and shall be located at MECR.

(b) Incident controller (IC)

Incident controller shall be a person who shall go to the scene of emergency and supervise the action plan to overcome or contain the emergency. Shift supervisor or Environmental Officer shall assume the charge of IC.

(c) Communication and advisory team

The advisory and communication team shall consist of heads of Mining Departments i.e., Mines Manager

(d) Roll call coordinator

The Mine Foreman shall be Roll Call Coordinator. The roll call coordinator will conduct the roll call and will evacuate the mine personnel to assembly point. His prime function shall be to account for all personnel on duty.

(e) Search and rescue team

There shall be a group of people trained and equipped to carryout rescue operation of trapped personnel. The people trained in first aid and fire-fighting shall be included in search and rescue team.

(f) Emergency security controller

Emergency Security Controller shall be senior most security person located at main gate office and directing the outside agencies e.g. fire brigade, police, doctor and media men etc.,

Emergency control procedure –

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The onset of emergency, will in all probability, commence with a major fire or explosion or collapse of wall along excavation and shall be detected by various safety devices and also by members of operational staff on duty. If located by a staff member on duty, he (as per site emergency procedure of which he is adequately briefed) will go to nearest alarm call point, break glass and trigger off the alarms. He will also try his best to inform about location and nature of accident to the emergency control room. In accordance with work emergency procedure the following key activities will immediately take place to interpret and take control of emergency.

- On site fire crew led by a fireman will arrive at the site of incident with fire foam tenders and necessary equipment.
- Emergency security controller will commence his role from main gate office
- Incident controller shall rush to the site of emergency and with the help of rescue team and will start handling the emergency.
- Site main controller will arrive at MECR with members of his advisory and communication team and will assume absolute control of the site.
  - He will receive information continuously from incident controller and give decisions and directions to:
    - Incident controller
    - Mine control rooms
    - Emergency security controller

Proposed fire extinguishers at different locations –

The following type of fire extinguishers has been proposed at strategic locations within the mine.

TABLE 7.3: PROPOSED FIRE EXTINGUISHERS AT DIFFERENT LOCATIONS

LOCATION	TYPE OF FIRE EXTINGUISHERS
Electrical Equipment's	CO_2 type, foam type, dry chemical powder type
Fuel Storage Area	CO_2 type, foam type, dry chemical powder type, Sand bucket
Office Area	Dry chemical type, foam type

Alarm system to be followed during disaster –

On receiving the message of disaster from Site Controller, fire-fighting team, the mine control room attendant will sound siren wailing for 5 minutes. Incident controller will arrange to broadcast disaster message through public address system.

On receiving the message of "Emergency Over" from Incident Controller the emergency control room attendant will give "All Clear Signal", by sounding alarm straight for 2 minutes.

The features of alarm system will be explained to one and all to avoid panic or misunderstanding during disaster.

In order to prevent or take care of hazard / disasters if any the following control measures have been adopted.

- All safety precautions and provisions of Metalliferous Mines Regulations (MMR), 1961 is strictly followed during all mining operations.
- Observance of all safety precautions for blasting and storage of explosives as per MMR 1961.
- Entry of unauthorized persons into mine & allied areas is completely prohibited.
- Fire-fighting and first-aid provisions in the mines office complex and mining area are provided.
- Provisions of all the safety appliances such as safety boot, helmets, goggles, dust masks, ear plugs and ear muffs etc. are made available to the employees and the use of same is strictly adhered to through regular monitoring.
- Training and refresher courses for all the employees working in hazardous premises.
- Working of mine, as per approved plans and regularly updating the mine plans.
- Cleaning of mine faces is regularly done.
- Handling of explosives, charging and blasting are carried out only by qualified persons following SOP.
- Checking and regular maintenance of garland drains and earthen bunds to avoid any inflow of surface water in the mine pit.

- Provision of high capacity standby pumps with generator sets with enough quantity of diesel for emergency pumping especially during monsoon.
- A blasting SIREN is used at the time of blasting for audio signal.
- Before blasting and after blasting, red and green flags are displayed as visual signals.
- Warning notice boards indicating the time of blasting and NOT TO TRESPASS are displayed at prominent places.
- Regular maintenance and testing of all mining equipment were carried out as per manufacturer's guidelines.

7.4   CUMULATIVE IMPACT STUDY

There are 4 existing quarries within a radius of 500 meters from the proposed project area. The list of quarries is as below –

TABLE 7.4: LIST OF QUARRIES WITHIN 500 METER RADIUS FROM THIS PROPOSAL

CLUSTER QUARRIES				
PROPOSED QUARRY				
CODE	**Name of the Owner**	**S.F.Nos & Village**	**Extent (ha)**	**Remarks**
P1	**Tvl. Navamani Mines Private Limited** Thiru. P.Mani, Managing Director, No.5/898, Alagu Nagar, Trichy Main Road, Namakkal District – 637 001	15/1 & 15/2 Sivayam (North) Village	2.80.5 ha	ToR obtained vide Lr.No. SEIAA-TN.F.No.6993/SEA C/TOR-761/2020 Dated 24.09.2020
	TOTAL		**2.80.5 ha**	
EXISTING QUARRIES				
CODE	**Name of the Owner**	**S.F.Nos & Village**	**Extent (ha)**	**Lease period**
E1	**Thiru. A.Shanmugaraj** S/o. Appavu, No 219, Manapparai Main Road, Iyyar Malai, Sivayam Post, Karur District	13/1, 14/2 and 14/3 Sivayam (North) Village	2.49.5 ha	07.02.2018 to 06.02.2023
E2	**Thiru. D. Rathinam** S/o. Duraisamy, 153/A, Kampan Street, Kavery Nagar, Kulithalai Taluk, Karur District	30/1A, 30/1B Sivayam (North) Village	2.46.0 ha	07.02.2018 to 06.02.2023
E3	**Tmt. M.Jayamani,** W/o. Manoharan Ponniyagoundanpudhur, Punnamchathiram, Aravakurichi Taluk, Karur District	30/4, 31/1 Sivayam (North) Village	1.04.0 ha	06.12.2018 to 05.12.2023
E4	**Thiru. M.Palaniyandi**, S/o, Mottiyandi, 2/34, Ambalakkara street, Somarasampettai, Srisangam Taluk, Trichy District.	2/2 Sivayam (North) Village	2.34.5 ha	10.07.2014 to 09.07.2019
	Total Extent		**5.99.50**	
	Total Cluster Extent		**8.80**	

TABLE 7.4 A: SALIENT FEATURES OF PROPOSAL "P1"

SALIENT FEATURES OF PROJECT				
Name of the Quarry	Tvl. Navamani Mines and Minerals Rough Stone and Gravel Quarry			
Mining Plan Period / Lease Period	5 Years			
	Pit	Length in m	Width in m	Depth in m
Existing Pit dimension	I	25	15	3
	II	37	18	3
Ultimate Pit dimension	I	208	103	38
Toposheet No	58 J/05			
Latitude between	10°52'19.57"N to 10°52'25.68"N			
Longitude between	78°22'26.70"E to 78°22'34.23"E			
Highest Elevation	124 m AMSL			
Geological Resources	Rough Stone in m^3		Gravel m^3	
	9,80,455		84,039	
Mineable Reserves	Rough Stone in m3		Gravel m3	
	3,95,935		49,332	
Water Level in the surrounds area	The Water table is found at a depth of 50m in summer and at 45m in rainy seasons.			
Method of Mining	Opencast Mechanized Mining Method involving drilling and blasting			
Machinery proposed	Jack Hammer	10 Nos		
	Compressor	2 Nos		
	Hydraulic Excavator	2 Nos		
	Tippers	5 Nos		
Blasting Method	Usage of Slurry Explosive with MSD detonators			
Proposed Manpower Deployment	36 Nos			
Project Cost	Project Cost	Rs 65, 68,505/-		
	EMP Cost	Rs 3, 80,000/-		
	Total	Rs 69, 48,505/-		
Cer Cost	Rs.5,00,000/-			

Source: Approved Mining Plan (Rc.No.256/Mines/2019 Dated: 24.06.2019)

TABLE 7.4 B: SALIENT FEATURES OF PROPOSAL "E1"

Name of the Mine	Rough Stone and Gravel Quarry belongs to Thiru A. Shanmugaraj	
Land Type	Patta Land	
S.F. No.	13/1,14/2, 14/3	
Village	Sivayam (North)	
Extent	2.49.5 ha	
Geological Reserves	Rough Stone	Gravel
	3,74,250m^3	49,900m^3
Mineable Reserves	Rough Stone	Gravel
	88,100m^3	7,128m^3
Mining Plan Period / Lease Period	5 Years	
Ultimate Pit Dimension	Pit – I 148 m (L) * 110 m (W) * 17 m (D) Pit – II 46 m (L) * 83 m (W) * 7 m (D)	
Toposheet No	58-J/05	
Latitude	10º52'20.66''N to 10º52'26.91''N	
Longitude	78º22'.20.17''E to 78º22'.26.94''E	
Highest Elevation	128 m AMSL	
Water Level	50-55 m bgl	
Machinery	Tractor mounted compressor attached with Jack Hammer Drills	2 Nos
	Hydraulic Excavator	1 No
	Tippers	2 Nos
Blasting	Usage of Slurry Explosive with MSD detonators	
Manpower Deployment	11 Nos	
Project Cost	Fixed asset Cost	Rs 6,49,000/-

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	Machinery Cost & Others	Rs 22, 00,000/-
	EMP Cost	Rs 7, 10,000/-
	Total	Rs 35, 59,000/-
Depth of Mining		38 meters

Source: Approved Mining Plan (Rc.No.490/Mines/2017 Dated: 11.07.2017)

TABLE 7.4C: SALIENT FEATURES OF PROPOSAL "E2"

Name of the Mine	Rough Stone and Gravel Quarry belongs to Thiru. D. Rathinam	
Land Type	Patta Land	
S.F. No.	30/1A & 30/1B	
Village	Sivayam (North)	
Extent	2.46.0 ha	
Geological Reserves	Rough Stone	Gravel
	3,74,250m^3	49,900m^3
Mineable Reserves	Rough Stone	Gravel
	88,100 m^3	7,128 m^3
Mining Plan Period / Lease Period	5 Years	
Ultimate Pit Dimension	282 m (L) * 65 m (W) * 17 m (D)	
Toposheet No	58-J/05	
Latitude between	10º52'05.21''E to 10º52'15.34''E	
Longitude between	78º22'33.69''E to 78º22'38.12''E	
Highest Elevation	125 m AMSL	
Water Level	50m 55m bgl	
Machinery	Tractor mounted compressor attached with jack hammer	2
	Hydraulic Excavator	1
	Tippers	1
Blasting	Usage of Slurry Explosive with MSD detonators	
Manpower Deployment	11 Nos	
Project Cost	Fixed asset Cost	Rs. 6,42,000/-
	Machinery Cost & Others	Rs. 42, 00,000/-
	EMP Cost	Rs. 7, 10,000/-
	Total	Rs. 55, 52,000/-
Depth of Mining	178 m bgl	

Source: Approved Mining Plan

TABLE 7.4D : SALIENT FEATURES OF PROPOSAL "E3"

Name of the Mine	Rough Stone and Gravel Quarry belongs to Thiru. M. Palaniyandi	
Land Type	Patta Land	
S.F. No.	2/2	
Village	Sivayam (North)	
Extent	2.34.5 ha	
Geological Reserves	Rough Stone	Gravel
	3, 69,000 m^3	49,200 m^3
Mineable Reserves	Rough Stone	Gravel
	1,40,785 m^3	13,536 m^3
Mining Plan Period / Lease Period	5 Years	
Ultimate Pit Dimension	218 m (L) * 69 m (W) * 12 m (D)	
Toposheet No	58-J/05	
Latitude between	N10º52'46'' to N10º52'36''	
Longitude between	E78º22'24'' to E78º22'28''E	
Highest Elevation	123 m AMSL	
Water Level	50 – 55 m	
Machinery	Jack Hammer Tractor mounted Compressor	1 Nos
	Hydraulic Excavator	1 No
	Tippers	2 Nos
Blasting	Usage of Slurry Explosive with MSD detonators	
Nearest Water Body	Cheyyar River – 3 kms SE Palar River – 7 kms N	
Manpower Deployment	12 Nos	

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Project Cost	Fixed Cost	Rs 10,03,500/-
	Operational Cost	Rs 46, 00,000/-
	EMP Cost	Rs 4, 05,000/-
	Total	Rs 60, 08,500/-
Depth of Mining	12 meters	

Source: Approved Mining Plan (Rc.No.99/Mines/2012 Dated: 10.09.2013)

TABLE 7.4E : SALIENT FEATURES OF PROPOSAL "E4"

Name of the Mine	Rough Stone & Gravel Quarry of Tmt . M. Jayamani		
Land Type	Patta Land		
S.F. No.	30/4, 31/1		
Village	Sivayam (North)		
Extent	1.04.0 ha		
Geological Reserves	Rough Stone	Gravel	
	1,70,840 m^3	68,336 m^3	
Mineable Reserves	Rough Stone	Gravel	
	90,105 m^3	50,652 m^3	
Mining Plan Period / Lease Period	5 Years		
Ultimate Pit Dimension	Pit I	71 m (L)	85 m (W)	14 m (D)
Toposheet No	58-J/05		
Latitude	N 10^{0}52'12''		
Longitude	E 78º22'37''		
Highest Elevation	124 m AMSL		
Water Level	50 – 55 m		
Machinery	Tractor mounted compressor	1 Nos	
	Hydraulic Excavator	1 No	
	Tippers	2 Nos	
Blasting	Usage of Slurry Explosive with MSD detonators		
Manpower Deployment	11 Nos		
Project Cost	Land Cost	Rs 67, 61,500/-	
	Machinery Cost & Others	Rs 7, 15,000/-	
	EMP Cost	Rs 8, 55,000/-	
	Total	Rs 76,16,500/-	
Depth of Mining	12 meters		

Source: Approved Mining Plan

The Cumulative Impact is mainly anticipated due to drilling & blasting and excavation and transportation activities in all the quarries (proposed and existing) within the cluster and major impact anticipated is on Air & Noise Environment and Ground Vibrations due to blasting.

Air Environment –

Calculating the Cumulative Load of Mining within the cluster is as shown in table 7.12 & 7.13.

TABLE 7.5: CUMULATIVE PRODUCTION LOAD OF ROUGH STONE

Quarry	Mineable Reserve in m^3	Per Year Productionin m^3	Per Day Production in m^3	Number of Lorry Load Per Day
P1	3,95,935	79,187	264	44 Trips/day
E1	88,100	7,690	26	4 Trips/day
E2	1,40,785	25,275	84	14 Trips/day
E3	1,28,350	17,102	57	10 Trips/day
E4	90,105	10,827	36	6 Trips/day
TOTAL	8,43,275	1,40,081	467	78 Trips/day

TABLE 7.6: CUMULATIVE PRODUCTION LOAD OF GRAVEL

Quarry	Mineable Reserve in m^3	Per Year Productionin m^3	Per Day Production in m^3	Number of Lorry Load Per Day
P1	49,332	24,666	82	14 Trips/day
E1	7,128	1,426	5	1 Trips/day

E2	13,536	2,707	9	2 Trips/day
E3	15,042	7,521	25	4 Trips/day
E4	50,652	5,246	17	3 Trips/day
TOTAL	1,35,690	41,566	138	24 Trips/day

On a cumulative basis considering all the 5 quarries (4 Existing and 1 Proposed) it can be seen that the overall production of Rough Stone is 467 m^3 per day and overall production of Gravel is 138 m^3 per day with an capacity of 190 trips of Rough Stone per day and 69 Trips per day of Gravel from the cluster.

Note: Per day production of Rough Stone is calculated for 5 Years Lease Period and for Gravel production with variable of 1, 2 and 3 years of production period. And the load of existing quarries will not be of major impact as these quarries lease period are nearing to its expiry.

Based on the above production quantities the emissions due to various activities in all the 8 mines includes various activities like ground preparation, excavation, handling and transport of ore. These activities have been analysed systematically basing on USEPA-Emission Estimation Technique Manual, for Mining AP-42, to arrive at possible emissions to the atmosphere and estimated emissions are given in Table 7.14.

TABLE 7.7: EMISSION ESTIMATION FROM QUARRIES WITHIN 500 METER RADIUS

EMISSION ESTIMATION FOR QUARRY "P1"				
	Activity	Source type	Value	Unit
Estimated Emission Rate for PM$_{10}$	Drilling	Point Source	0.123080351	g/s
	Blasting	Point Source	0.001037626	g/s
	Mineral Loading	Point Source	0.046813500	g/s
	Haul Road	Line Source	0.002580263	g/s/m
	Overall Mine	Area Source	1.255619403	g/s
Estimated Emission Rate for SO$_2$	Overall Mine	Area Source	0.02554754	g/s
Estimated Emission Rate for NOx	Overall Mine	Area Source	0.086958405	g/s
EMISSION ESTIMATION FOR QUARRY "E1"				
	Activity	Source type	Value	Unit
Estimated Emission Rate for PM$_{10}$	Drilling	Point Source	0.064165307	g/s
	Blasting	Point Source	0.000615374	g/s
	Mineral Loading	Point Source	0.046097400	g/s
	Haul Road	Line Source	0.002575675	g/s/m
	Overall Mine	Area Source	1.129585285	g/s
Estimated Emission Rate for SO$_2$	Overall Mine	Area Source	0.00023799	g/s
Estimated Emission Rate for NOx	Overall Mine	Area Source	0.006951763	g/s
EMISSION ESTIMATION FOR QUARRY "E2"				
	Activity	Source type	Value	Unit
Estimated Emission Rate for PM$_{10}$	Drilling	Point Source	0.091220418	g/s
	Blasting	Point Source	0.000860011	g/s
	Mineral Loading	Point Source	0.038535527	g/s
	Haul Road	Line Source	0.002552732	g/s/m
	Overall Mine	Area Source	1.142651517	g/s
Estimated Emission Rate for SO$_2$	Overall Mine	Area Source	0.000734024	g/s
Estimated Emission Rate for NOx	Overall Mine	Area Source	0.021601729	g/s
EMISSION ESTIMATION FOR QUARRY "E3"				
	Activity	Source type	Value	Unit
Estimated Emission Rate for PM$_{10}$	Drilling	Point Source	0.078072714	g/s
	Blasting	Point Source	0.000468131	g/s
	Mineral Loading	Point Source	0.041301355	g/s
	Haul Road	Line Source	0.002557321	g/s/m
	Overall Mine	Area Source	1.118000656	g/s
Estimated Emission Rate for SO$_2$	Overall Mine	Area Source	0.000616529	g/s
Estimated Emission Rate for NOx	Overall Mine	Area Source	0.017348740	g/s
EMISSION ESTIMATION FOR QUARRY "E4"				
Estimated Emission Rate for PM$_{10}$	Activity	Source type	Value	Unit

	Drilling	Point Source	0.050881821	g/s
	Blasting	Point Source	0.000217568	g/s
	Mineral Loading	Point Source	0.041301355	g/s
	Haul Road	Line Source	0.002550438	g/s/m
	Overall Mine	Area Source	0.979271897	g/s
Estimated Emission Rate for SO$_2$	Overall Mine	Area Source	0.000389346	g/s
Estimated Emission Rate for NOx	Overall Mine	Area Source	0.008197171	g/s

Source: Emission Calculations

TABLE 7.8: INCREMENTAL & RESULTANT GLC WITHIN CLUSTER

PM$_{10}$ in µg/m^3	
Location	CORE
Background	47.1
Highest Incremental	16
Resultant	63.1
NAAQ Norms	100 µg/m^3
PM$_{2.5}$ in µg/m^3	
Location	CORE
Background	22.9
Highest Incremental	9
Resultant	31.95
NAAQ Norms	60 µg/m^3
SO$_2$ in µg/m^3	
Location	CORE
Background	6.9
Highest Incremental	3.89
Resultant	10.79
NAAQ Norms	80 µg/m^3
NO$_x$ in µg/m^3	
Location	CORE
Background	24.1
Incremental	9.65
Resultant	33.75
NAAQ Norms	80 µg/m^3

Noise Environment –

Noise pollution is mainly due to operation like drilling & blasting and plying of trucks & HEMM. Cumulative Noise modelling has been carried out considering blasting and compressor operation (drilling) and transportation activities. Predictions have been carried out to compute the noise level at various distances around the different quarries within the 500 m radius.

For hemispherical sound wave propagation through homogeneous loss free medium, one can estimate noise levels at various locations at different sources using model based on first principle.

$Lp_2 = Lp_1 - 20 \log (r_2/r_1) - Ae_{1,2}$

Where:

Lp_1 & Lp_2 are sound levels at points located at distances r_1 & r_2 from the source.

$Ae_{1,2}$ is the excess attenuation due to environmental conditions. Combined effect of all sources can be determined at various locations by logarithmic addition.

$Lp_{total} = 10 \log \{10^{(Lp1/10)} + 10^{(Lp2/10)} + 10^{(Lp3/10)} + \ldots\ldots\}$

Attenuation due to Green Belt has been taken to be 4.9 dB (A). The inputs required for the model are:

Source data has been computed taking into account of all the machinery and activities used in the mining process.

TABLE 7.9: PREDICTED NOISE INCREMENTAL VALUES FROM CLUSTER

Location ID	Background Value (Day) dB(A)	Incremental Value dB(A)	Total Predicted dB(A)	Residential Area Standards dB(A)
Habitation Near P1	44.2	47.0	48.9	
Habitation Near E1	48.0	51.5	53.1	
Habitation Near E2	42.3	45.3	47.1	55
Habitation Near E3	42.8	43.0	45.9	
Habitation Near E4	43.1	45.8	47.7	

Source: Lab Monitoring Data

The incremental noise level is found within the range of 43.0 – 51.5 dB (A) in Buffer zone. The noise level at different receptors in buffer zone is lower due to the distance involved and other topographical features adding to the noise attenuation. The resultant Noise level due to monitored values and calculated values at the receptors are based on the mathematical formula considering attenuation due to Green Belt as 4.9 dB (A) the barrier effect. From the above table, it can be seen that the ambient noise levels at all the locations near habitations are within permissible limits of Residential Area (buffer zone) as per THE NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000 (The Principal Rules were published in the Gazette of India, vide S.O. 123(E), dated 14.2.2000 and subsequently amended vide S.O. 1046(E), dated 22.11.2000, S.O. 1088(E), dated 11.10.2002, S.O. 1569 (E), dated 19.09.2006 and S.O. 50 (E) dated 11.01.2010 under the Environment (Protection) Act, 1986.).

Ground Vibrations

Ground vibrations due to mining activities in the all the Mines within cluster are anticipated due to operation of Mining Machines like Excavators, drilling and blasting, transportation vehicles, etc. However, the major source of ground vibration from the all the mines is blasting. The major impact of the ground vibrations is observed on the domestic houses located in the villages nearby the mine lease area. The kuchha houses are more prone to cracks and damage due to the vibrations induced by blasting whereas RCC framed structures can withstand more ground vibrations. Apart from this, the ground vibrations may develop a fear factor in the nearby settlements.

Another impact due to blasting activities is fly rocks. These may fall on the houses or agricultural fields nearby the mining areas and may cause injury to persons or damage to the structures.

Nearest Habitations from 5 mines respectively are as in below Table 7.17

TABLE 7.10: NEAREST HABITATION FROM EACH MINE

Location ID	Distance in Meters
Habitation Near P1	450
Habitation Near E1	270
Habitation Near E2	550
Habitation Near E3	720
Habitation Near E4	520

The ground vibrations due to the blasting in all the mines are calculated using the empirical equation for assessment of peak particle velocity (PPV) is:

$$V = K [R/Q^{0.5}]^{-B}$$

Where –
V = peak particle velocity (mm/s)
K = site and rock factor constant
Q = maximum instantaneous charge (kg)
B = constant related to the rock and site (usually 1.6)
R = distance from charge (m)

TABLE 7.11: GROUND VIBRATIONS AT 8 MINES

Location ID	Maximum Charge in kgs	Nearest Habitation in m	PPV in m/ms
P1	100	450	1.0
E1	56	320	1.95
E2	64	550	0.821
E3	58	550	0.821
E4	49	500	0.956

Source: Blasting Calculations

From the above table, the charge per blast is considered as maximum of 100kg in each mine and the resultant PPV is well below the Peak Particle Velocity of 8 mm/s as per Directorate General of Mines Safety for safe level criteria through Circular No. 7 dated 29/8/1997.

Socio Economic Environment –

The 8 mines shall provide employment and revenue will be created to government

TABLE 7.12: SOCIO ECONOMIC BENEFITS FROM 8 MINES

	Employment	Project Cost	CER Cost
P1	36	Rs 64,48,505/-	Rs 5,00,000/-
E1	11	Rs 35,59,000/-	Rs 72,000/-
E2	11	Rs 55,52,000/-	Rs 1, 11,000/-
E3	12	Rs 60, 08,500/-	Rs 1, 20,000/-
E4	11	Rs 76, 16,500/-	Rs 1, 52,330/-
Total	**81**	**Rs 2,91,84,505/-**	**Rs 9,55,330/-**

A total of 81 people will get employment from these cluster quarries and already employed at existing mines are 45 Nos. Allocation for Corporate Environment Responsibility (CER) shall be made as per Government of India, MoEF & CC Office Memorandum F.No.22-65/2017-IA.III, Dated: 01.05.2018 by all the mines

As per para 6 (II) of the office memorandum, all the mines being a green field project & Capital Investment is ≤ 100 crores, they shall contribute 2% of Capital Investment towards CER as per directions of EAC/SEAC and the total CER amount from the 5 mines is Rs 9,55,330/-.

8.   PROJECT BENEFITS

8.0   GENERAL

Tvl Navamani Mines Pvt Ltd Rough Stone and Gravel Cluster – Proposed Quarries aims to produce about – 3,95,935 m^3 Rough Stone & 49,332 m^3 of Gravel over a period of 5 Years. This will enhance the socio-economic activities in the adjoining areas and will result in the following benefits

- Increase in Employment Potential
- Improvement in Socio-Economic Welfare
- Improvement in Physical Infrastructure
- Improvement in Social infrastructure

8.1   EMPLOYMENT POTENTIAL

It is proposed to provide employment to about 36 persons for carrying out mining operations and give preference to the local people in providing employment. In addition, there will be opportunity for indirect employment to many people in the form of contractual jobs, business opportunities, service facilities etc. the economic status of the local people will be enhanced due to mining project.

8.2   SOCIO-ECONOMIC WELFARE MEASURES PROPOSED

The impact of mining activity in the area will be more positive on the socio-economic environment in the immediate project impact area. The employment opportunities both direct and indirect will contribute to enhanced money incomes to job seekers with minimal skill sets especially among the local communities.

8.3   IMPROVEMENT IN PHYSICAL INFRASTRUCTURE

The proposed quarry is located in Sivayam (North) Village, Krishnarayapuram Taluk and Karur District of Tamil Nadu and the area have communications, roads and other facilities already well established. The following physical infrastructure facilities will further improve due to proposed mine.

- Road Transport facilities
- Communications
- Medical, Educational and social benefits will be made available to the nearby civilian population in addition to the workmen employed in the mine.

8.4   IMPROVEMENT IN SOCIAL INFRASTRUCTURE

Employment is expected during civil construction period, in trade, garbage lifting, sanitation and other ancillary services, Employment in these sectors will be primarily temporary or contractual and involvement of unskilled labour will be more. A major part of the labour force will be mainly from local villagers who are expected to engage themselves both in agriculture and mining activities. This will enhance their income and lead to overall economic growth of the area.

8.5   OTHER TANGIBLE BENEFITS

The proposed mine is likely to have other tangible benefits as given below.

- Indirect employment opportunities to local people in contractual works like construction of infrastructural facilities, transportation, sanitation, for supply of goods and services to the mine and other community services.
- Additional housing demand for rental accommodation will increase
- Cultural, recreation and aesthetic facilities will also improve
- Improvement in communication, transport, education, community development and medical facilities and overall change in employment and income opportunity
- The State Government will also benefit directly from the proposed mine, through increased revenue from royalties, cess, DMF, GST etc.,

CORPORATE SOCIAL RESPONSIBILITY

The Proponent will take responsibility to develop awareness among all levels of their staff about CSR activities and the integration of social processes with business processes. Those involved with the undertaking of CSR activities will be provided with adequate training and re-orientation.

Under this programme, the project proponent will take-up following programmes for social and economic development of villages within 10 km of the project site. For this purpose, separate budget will be provided every year. For finalization of these schemes, proponent will interact with LSG. The schemes will be selected from the following broad areas –

- Health Services
- Social Development
- Infrastructure Development
- Education & Sports
- Self-Employment

CSR Cost Estimation

CSR activities will be taken up in the Sivayam (North) village mainly contributing to education, health, training of women self-help groups and contribution to infrastructure etc., CSR budget is allocated as 2.5% of the profit.

CORPORATE ENVIRONMENT RESPONSIBILITY–

Allocation for Corporate Environment Responsibility (CER) shall be made as per Government of India, MoEF & CC Office Memorandum F.No.22-65/2017-IA.III, Dated: 01.05.2018.

As per para 6 (II) of the office memorandum, being a green field project & Capital Investment is ≤ 100 crores, The Cluster Projects of four proposed and four existing quarry owners shall contribute 2% of Capital Investment towards CER as per directions of EAC/SEAC. Capital cost is Rs 69,48,505/- and 2% of the same works out to Rs 1, 38,970/-.

TABLE 8.1: CER – ACTION PLAN

Activity	Beneficiaries	Total In Rs
Installation of Solar lamps at Sivayam (north) village roads	Government Elementary School, Irumboothipatti	5,00,000
Renovation of Existing toilets for		
Providing Environment related books		
Total		**5,00,000**

Source: Field survey conducted by FAE, consultation with project proponent

9.   ENVIRONMENTAL COST BENEFIT ANALYSIS

Not Applicable, Since Environmental Cost Benefit Analysis not recommended at the Scoping stage.

10.   ENVIRONMENTAL MANAGEMENT PLAN FOR CLUSTER

10.0   GENERAL

Environment Management Plan (EMP) aims at the preservation of ecological system by considering in-built pollution abatement facilities at the proposed site. Good practices of Environmental Management plan will ensure to keep all the environmental parameters of the project in respect of Ambient Air quality, Water quality, Socio – economic improvement standards.

Mitigation measures at the source level and an overall environment management plan at the study area are elicited so as to improve the supportive capacity of the receiving bodies. The EMP presented in this chapter discusses the administrative aspects of ensuring that mitigative measures are implemented and their effectiveness monitored after approval of the EIA.

10.1   ENVIRONMENTAL POLICY

The Project Proponent committed to conduct all its operations and activities in an environmentally responsible manner and to continually improve environmental performance.

The Proponent will –Tvl Navamni Mines Pvt Ltd

- Allocate necessary resources to ensure the implementation of the environmental policy
- Meet the requirements of all laws, acts, regulations, and standards relevant to its operations and activities
- Implement a program to train employees in general environmental issues and individual workplace environmental responsibilities
- Ensure that an effective closure strategy is in place at all stages of project development and that progressive reclamation is undertaken as early as possible to reduce potential long-term environmental and community impacts
- Implement monitoring programmes to provide early warning of any deficiency or unanticipated performance in environmental safeguards
- Conduct periodic reviews to verify environmental performance and to continuously strive towards improvement

Description of the Administration and Technical Setup –

The Environment Monitoring Cell discussed under Chapter 6 will ensure effective implementation of environment management plan and to ensure compliance of environmental statutory guidelines through Mine Management Level of the proposed quarry.

The said team will be responsible for:

- Analysis of the water and air samples collected through external laboratory
- Monitoring of the water/ waste water quality, air quality and solid waste generated
- Implementation and monitoring of the pollution control and protective measures/ devices which shall include financial estimation, ordering, installation of air pollution control equipment, waste water treatment plant, etc.,
- Co-ordination of the environment related activities within the project as well as with outside agencies
- Collection of health statistics of the workers and population of the surrounding villages
- Green belt development
- Monitoring the progress of implementation of the environmental monitoring programme
- Compliance to statutory provisions, norms of State Pollution Control Board, Ministry of Environment and Forests and the conditions of the environmental clearance as well as the consents to establish and consents to operate.

10.2　LAND ENVIRONMENT MANAGEMENT –

Landscape of the area will be changed due to the quarrying operation, restoration of the land by converting the quarry pit into temporary reservoir and the remaining part of the area (un utilized areas, infrastructure, haul Roads) will be utilized for greenbelt development. Aesthetic of the Environment will not be affected. There is no major vegetation in the project area during the course of quarrying operation and after completion of the quarrying operation thick plantation will be developed under greenbelt development programme.

TABLE 10.1: PROPOSED CONTROLS FOR LAND ENVIRONMENT

CONTROL	RESPONSIBILITY
Design vehicle wash-down areas so that all runoff water is captured and passed through oil water separators and sediment catchment devices.	Mines Manager
Re fueling to be undertaken in a safe location, away from vehicle movement pathways & 100 m away of any watercourse Re fueling activity to be under visual observation at all times. Drainage of refueling areas to sumps with oil/water separation	Mine Foreman & Mining Mate
Soil and groundwater testing as required following up a particular incident of contamination.	Mines Manager
At conceptual stage, the mining pits will be converted into Rain Water Harvesting. Remaining area will be converted into greenbelt area	Mines Manager
No external dumping i.e., outside the project area	Mine Foreman
Garland drains with catch pits / settlement traps to be provided all around the project area to prevent run off affecting the surrounding lands.	Mines Manager
The periphery of Project area will be planted with thick plantation to arrest the fugitive dust, which will also act as acoustic barrier.	Mines Manager

Source: Proposed by FAE's & EIA Coordinator

10.3　SOIL MANAGEMENT

Top Soil Management –

▪ There is no topsoil for this project site.

Overburden / Waste and Side Burden Management –

▪ The overburden in the form of Gravel formation, the Gravel will be directly loaded into tippers and sold.

TABLE 10.2: PROPOSED CONTROLS FOR SOIL MANAGEMENT

CONTROL	RESPONSIBILITY
Surface run-off from the project boundary via garland drains will be diverted to the mine pits	Mine Foreman & Mining Mate
Design haul roads and other access roads with drainage systems to minimize concentration of flow and erosion risk	Mines Manager
Empty sediment from sediment traps Maintain, repair or upgrade garland drain system	Mines Manager
Test soils for pH, EC, chloride, size & water holding capacity	Manager Mines

Source: Proposed by FAE's & EIA Coordinator

10.4   WATER MANAGEMENT

In the proposed quarrying project no process is involved for the effluent generation, only oil & grease from the machinery wash is anticipated and domestic sewage from mine office.

The quarrying operation is proposed upto a depth of 12m – 38m maximum below ground level, the water table in the area is 50m – 55m below ground level, hence the proposed projects will not intersect the Ground water table during entire quarry period.

TABLE 10.3: PROPOSED CONTROLS FOR WATER ENVIRONMENT

CONTROL	RESPONSIBILITY
To maximize the reuse of pit water for water supply	Mines Foreman
Temporary and permanent garland drain will be constructed to contain the catchments of the mining area and to divert runoff from undisturbed areas through the mining areas	Mines Manager
Natural drains/nallahs/brooklets outside the project area should not be disturbed at any point of mining operations	Mines Manager
Ensure there is no process effluent generation or discharge from the project area into water bodies	Mines Foreman
Domestic sewage generated from the project area will be disposed in septic tank and soak pit system	Mines Foreman
Monthly or after rainfall, inspection for performance of water management structures and systems	Mines Manager
Conduct ground water and surface water monitoring for parameters specified by CPCB	Manager Mines

Source: Proposed by FAE's & EIA Coordinator

10.5   AIR QUALITY MANAGEMENT

The proposed quarrying activity would result in the increase of particulate matter concentrations due to fugitive dust. Daily water sprinkling on the haul roads, approach roads in the vicinity would be undertaken and will be continued as there is possibility for dust generation due to truck mobility. It will be ensured that vehicles are properly maintained to comply with exhaust emission requirements

TABLE 10.4: PROPOSED CONTROLS FOR AIR ENVIRONMENT

CONTROL	RESPONSIBILITY
Generation of dust during excavation is minimized by daily (twice) water sprinkling on working face and daily (twice) water sprinkling on haul road	Mines Manager
Wet drilling procedure /drills with dust extractor system to control dust generation during drilling at source itself is implemented	Mines Manager
Maintenance as per operator manual of the equipment and machinery in the mines to minimizing air pollution	Mines Manager
Ambient Air Quality Monitoring carried out in the project area and in surrounding villages to access the impact due to the mining activities and the efficacy of the adopted air pollution control measures	Mines Manager
Provision of Dust Mask to all workers	Mines Manager
Greenbelt development all along the periphery of the project area	Mines Manager

Source: Proposed by FAE's & EIA Coordinator

GEO EXPLORATION AND MINING SOLUTIONS

10.5.1 NOISE POLLUTION CONTROL

There will be intermittent noise levels due to vehicular movement, trucks loading, drilling and blasting and cutting activities. No mining activities are planned during night time.

TABLE 10.5: PROPOSED CONTROLS FOR NOISE ENVIRONMENT

CONTROL	RESPONSIBILITY
Development of thick greenbelt all along the Buffer Zone (7.5 Meters) of the project area to attenuate the noise and the same will be maintained	Mines Manager
Preventive maintenance of mining machinery and replacement of worn out accessories to control noise generation	Mines Foreman
Deployment of mining equipment with an inbuilt mechanism to reduce noise	Mines Manager
Provision of earmuff / ear plugs to workers working in noise prone zones in the mines	Mining Mate
Provision of effective silencers for mining machinery and transport vehicles	Mines Manager
Provision of sound proof AC operator cabins to HEMM	Mines Manager
Sharp drill bits are used to minimize noise from drilling	Mines Foreman
Controlled blasting technologies are adopted by using delay detonators to minimize noise from blasting	Mines Manager
Annual ambient noise level monitoring are carried out in the project area and in surrounding villages to access the impact due to the mining activities and the efficacy of the adopted noise control measures. Additional noise control measures will be adopted if required as per the observations during monitoring	Mines Manager
Reduce maximum instantaneous charge using delays while blasting	Mining Mate
Change the burden and spacing by altering the drilling pattern and/or delay layout, or altering the hole inclination	Mines Manager
Undertake noise or vibration monitoring	Mines Manager

Source: Proposed by FAE's & EIA Coordinator

10.5.2 GROUND VIBRATION AND FLY ROCK CONTROL

The Rough stone and Gravel quarry operation creates vibration due to the blasting and movement of Heavy Earth moving machineries, fly rocks due to the blasting.

TABLE 10.6: PROPOSED CONTROLS FOR GROUND VIBRATIONS & FLY ROCK

CONTROL	RESPONSIBILITY
Controlled blasting using delay detonators will be carried out to maintain the PPV value (below 8Hz) well within the prescribed standards of DGMS	Mines Manager
Drilling and blasting will be carried under the supervision of qualified persons	Mines Manager
Proper stemming of holes should be carried out with statutory competent qualified blaster under the supervision of statutory mines manager to avoid any anomalies during blasting	Mines Manager
Suitable spacing and burden will be maintained to avoid misfire / fly rocks	Manager Mines
Number of blast holes will be restricted to control ground vibrations	Manager Mines
Blasting will be carried out only during noon time	Mining Mate
Undertake noise or vibration monitoring	Mines Manager
ensure blast holes are adequately stemmed for the depth of the hole and stemmed with suitable angular material	Mines Foreman

Source: Proposed by FAE's & EIA Coordinator

10.8   BIOLOGICAL ENVIRONMENT MANAGEMENT

The proponent's will take all necessary steps to avoid the impact on the ecology of the area by adopting suitable management measures in the planning and implementation stage. During mining, thick plantation will be carried out around the project periphery, on safety barrier zone, on top benches of quarried out area etc.,

Following control measures are proposed for its management and will be the responsibility of the Mines Manager.
*   Greenbelt development all along the safety barrier of the project area
*   It is also proposed to implement the greenbelt development programme and post plantation status will be regularly checked for every season.
*   The main attributes that retards the survival of sapling is fugitive dust, this fugitive dust can be controlled by water sprinkling on the haul roads and installing a sprinkler unit near the newly planted area.
*   Year wise greenbelt development will be recorded and monitored
    *   Based on the area of plantation.
    *   Period of plantation
    *   Type of plantation
    *   Spacing between the plants
    *   Type of manuring and fertilizers and its periods
    *   Lopping period, interval of watering
    *   Survival rate
    *   Density of plantation
*   The ultimate reclamation planned leaves a congenial environment for development of flora & immigration of small fauna through green belt and water reservoir. The green belt and water reservoir developed within the Project at the end of mine life will attract the birds and animals towards the project area in the post mining period.

10.8.1   Green Belt Development Plan

About 1680 nos. of saplings is proposed to be planted for the Mining plan period in safety barrier of all the proposed projects with survival rate 80% and about 1400 nos. of fruit bearing and avenue plants are proposed to be developed around the mines office. The greenbelt development plan has been prepared keeping in view the land use changes that will occur due to mining operation in the area.

TABLE 10.7 PROPOSED GREENBELT ACTIVITIES FOR 5 YEAR PLAN PERIOD

PROJECT	No. of tress proposed to be planted	Area to be covered in m^2	Survival rate expected in %	No. of trees expected to be grown
P1	1680	Near by 7.5m safety distance, panchayat road and villagre road	80	1400
E1	175		80	140
E2	175		80	140
E3	100		80	80
E4	50		80	40
Total	**2180**		**80**	**1800**

Source: Approved mining plan for all the projects

The plantation is being carried out in the existing quarries by planting local species Neem, Pongamia pinnata, etc., the same local species is proposed to plant in the proposed project

The objectives of the greenbelt development plan are –
*   Provide a green belt around the periphery of the quarry area to combat the dispersal of dust in the adjoining areas,
*   Protect the erosion of the soil, Conserve moisture for increasing ground water recharging,
*   Restore the ecology of the area, Restore aesthetic beauty of the locality and meet the requirement of fodder, fuel and timber of the local community.

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A well planned Green Belt with multi rows (three tiers) preferably with long canopy leaves shall be developed with dense plantations around the boundary and haul roads to prevent air, dust noise propagation to undesired places and efforts will be taken for the enhancement of survival rate.

10.8.2   Species Recommended for Plantation

Following points have been considered while recommending the species for plantation:

- Creating of bio-diversity.
- Fast growing, thick canopy cover, perennial and evergreen large leaf area,
- Efficient in absorbing pollutants without major effects on natural growth

TABLE 10.8: RECOMMENDED SPECIES TO PLANT IN THE GREENBELT

S.No	Botanical Name	Local Name	Importance
1.	Azadirachta indica	Neem, Vembu	Neem oil & neem products
2.	Millettia pinnata	Pungan	landscaping purposes as a windbreak or for shade
3.	Tamarindusindica	Tamarind	Edible & Medicinal and other Uses
4.	Achras sapota	Sapota	Edible fruits
5.	Ficus benghalensis	Alai	Shade and a source of food for birds
6.	Ficus religiosa	araca-maram	Shade and a source of food for birds
7.	Mangifera indica	Mango/ Ma	Edible fruit
8.	Terminalia catappa	nattuvadumai	Edible nuts
9.	Polyalthia longifolia	Nettilinkam	Tall and evergreen tree
10.		Athi palam	

Source: Proposed by FAE's & EIA Coordinator

10.9   OCCUPATIONAL SAFETY & HEALTH MANAGEMENT

Occupational safety and health is very closely related to productivity and good employer-employee relationship. The main factors of occupational health impact in quarries are fugitive dust and noise. Safety of employees during quarrying operation and maintenance of mining equipment will be taken care as per Mines Act 1952 and Rule 29 of Mines Rules 1955. To avoid any adverse effect on the health of workers due to dust, noise and vibration sufficient measures have been provided.

10.9.1   Medical Surveillance and Examinations –

- Identifying workers with conditions that may be aggravated by exposure to dust & noise and establishing baseline measures for determining changes in health.

- Evaluating the effect of noise on workers

- Enabling corrective actions to be taken when necessary

- Providing health education

The health status of workers in the mine shall be regularly monitored under an occupational surveillance program. Under this program, all the employees are subjected to a details medical examination at the time of employment. The medical examination covers the following tests under mines act 1952.

- General Physical Examination and Blood Pressure

- X-ray Chest and ECG

- Sputum test

- Detailed Routine Blood and Urine examination

The medical histories of all employees will be maintained in a standard format annually. Thereafter, the employees will be subject to medical examination annually. The below tests keep upgrading the database of medical history of the employees.

TABLE 10.9: MEDICAL EXAMINATION SCHEDULE

Sl.No	Activities	1st Year	2nd Year	3rd Year	4th Year	5th Year
1	Initial Medical Examination (Mine Workers)					
A	Physical Check-up					
B	Psychological Test					
C	Audiometric Test					
D	Respiratory Test					
2	Periodical Medical Examination (Mine Workers)					
A	Physical Check – up					
B	Audiometric Test					
C	Eye Check – up					
D	Respiratory Test					
3	Medical Camp (Mine Workers & Nearby Villagers)					
4	Training (Mine Workers)					

Medical Follow ups:- Work force will be divided into three targeted groups age wise as follows:-		
Age Group	**PME as per Mines Rules 1955**	**Special Examination**
Less than 25 years	Once in a Three Years	In case of emergencies
Between 25 to 40 Years	Once in a Three Years	In case of emergencies
Above 40 Years	Once in a Three Years	In case of emergencies
Medical help on top priority immediately after diagnosis/ accident is the essence of preventive aspects.		

10.9.2   Proposed Occupational Health and Safety Measures –

▪ The mine site will have adequate drinking water supply so that workers do not get dehydrated.

▪ Lightweight and loose fitting clothes having light colors will be preferred to wear.

▪ Noise exposure measurements will be taken to determine the need for noise control strategies.

▪ The personal protective equipment will be provided for mine workers.

▪ Supervisor will be instructed for reporting any problems with hearing protectors or noise control equipment.

▪ At noisy working activity, exposure time will be minimized.

▪ Dust generating sources will be identified and proper control measure will be adopted.

▪ Periodic medical examinations will be provided for all workers.

▪ Strict observance of the provisions of DGMS Acts, Rules and Regulations in respect of safety both by management and the workers.

▪ The width of road will be maintained more than thrice the width of the vehicle. A code of traffic rules will be implemented.

▪ In respect of contract work, safety code for contractors and workers will be implemented. They will be allowed to work under strict supervision of statutory person/officials only after they will impart training at vocational training centres. All personal protective equipment's will be provided to them.

▪ A safety committee meeting every month will be organized to discuss the safety of the mines and the persons employed.

▪ Celebration of annual mines safety week and environmental week in order to develop safety awareness and harmony amongst employees and co quarry owners.

FIGURE 10.1: PERSONAL PROTECTIVE EQUIPMENT TO THE MINE WORKERS

10.9.3 Health and Safety Training Programme

The Proponent's will provide special induction program along with machinery manufacturers for the operators and co-operators to run and maintain the machinery effectively and efficiently. The training program for the supervisors and office staffs will be arranged in the Group Vocational Training Centres in the State. And engage an Environmental Consultants to provide periodical training to all the employees to carry out the mining operation in and eco-friendly manner.

TABLE 10.10: LIST OF PERIODICAL TRAININGS PROPOSED FOR EMPLOYEES

Course	Personnel	Frequency	Duration	Instruction
New-Employee Training	All new employees exposed to mine hazards	Once	One week	Employee rights Supervisor responsibilities Self-rescue Respiratory devices Transportation controls Communication systems Escape and emergency evacuation Ground control hazards Occupational health hazards Electrical hazards First aid Explosives
Task Training Like Drilling, Blasting, Stemming, safety, Slope stability, Dewatering, Haul road maintenance,	Employees assigned to new work tasks	Before new Assignments	Variable	Task-specific health & safety procedures and SOP for various mining activity. Supervised practice in assigned work tasks.
Refresher Training	All employees who received new-hire training	Yearly	One week	Required health and safety standards Transportation controls Communication systems Escape ways, emergency evacuations Fire warning Ground control hazards First aid Electrical hazards Accident prevention Explosives

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				Respirator devices
Hazard Training	All employees exposed to mine hazards	Once	Variable	Hazard recognition and avoidance Emergency evacuation procedures Health standards Safety rules Respiratory devices

Source: Proposed by FAE's & EIA Coordinator as per DGMS Norms

10.9.4   Budgetary Provision for Environmental Management –

Adequate budgetary provision has been made by the Company for execution of Environmental Management Plan. The Table 10.12 gives overall investment on the environmental safeguards and recurring expenditure for successful monitoring and implementation of control measures.

TABLE 10.11: EMP BUDGET FOR PROPOSED PROJECTS IN CLUSTER

	Mitigation Measure	Provision for Implementation	Capital	Recurring
Air Environment	Compaction, gradation and drainage on both sides for Haulage Road	Rental Dozer & drainage construction on haul road @ Rs. 10,000/- per hectare; and yearly maintenance @ Rs. 10,000/- per hectare	28050	28050
	Fixed Water Sprinkling Arrangements + Water sprinkling by own water tankers	Fixed Sprinkler Installation and New Water Tanker Cost for Capital; and Water Sprinkling (thrice a day) Cost for recurring	800000	50000
	Muffle blasting – To control fly rocks during blasting	Blasting face will be covered with sand bags / steel mesh / old tyres / used conveyor belts	0	5000
	Wet drilling procedure / latest eco-friendly drill machine with separate dust extractor unit	Dust extractor @ Rs. 25,000/- per unit deployed as capital & @ Rs. 2500 per unit recurring cost for maintenance - 10 Units	250000	25000
	No overloading of trucks/tippers/tractors	Manual Monitoring through Security guard	0	5000
	Stone carrying trucks will be covered by tarpaulin	Monitoring if trucks will be covered by tarpaulin	0	10000
	Enforcing speed limits of 20 km/hr within ML area	Installation of Speed Governers @ Rs. 5000/- per Tipper/Dumper deployed - 5 Units	25000	1250

	Regular monitoring of exhaust fumes as per RTO norms	Monitoring of Exhaust Fumes by Manual Labour	0	5000
	Regular sweeping and maintenance of approach roads for at least about 200 m from ML Area	Provision for 2 labours @ Rs.10,000/labour (Contractual) per Hectare	0	56100
	Installing wheel wash system near gate of quarry	Installation + Maintenance + Supervision	50000	20000
Noise Environment	Source of noise will be during operation of transportation vehicles, HEMM for this proper maintenance will be done at regular intervals.	Provision made in Operating Cost	0	0
	Oiling & greasing of Transport vehicles and HEMM at regular interval will be done	Provision made in Operating Cost	0	0
	Adequate silencers will be provided in all the diesel engines of vehicles.	Provision made in Operating Cost	0	0
	It will be ensured that all transportation vehicles carry a fitness certificate.	Provision made in Operating Cost	0	0
	Safety tools and implements that are required will be kept adequately near blasting site at the time of charging.	Provision made in OHS part	0	0
	Line Drilling all along the boundary to reduce the PPV from blasting activity and implementing controlled blasting.	Provision made in Operating Cost	0	0
	Proper warning system before blasting will be adopted and clearance of the area before blasting will be ensured.	Blowing Whistle by Mining Mate / Blaster / Compentent Person	0	0
	Provision for Portable blaster shed	Installation of Portable blasting shelter	50000	2000
	NONEL Blasting will be practiced to control Ground vibration and fly rocks	Rs. 30/- per 6 Tonnes of Blasted Material	0	1029431
Waste Management	Waste management (Spent Oil, Grease etc.,)	Provision for domestic waste collection and disposal through authorized agency	5000	20000
		Installation of dust bins	5000	2000
	Bio toilets will be made available outside mine lease on the land of owner itself	Provision made in Operating Cost	0	0

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Mine Closure	1. Progressive Closure Activity - Surface Runoff managent	Provision for garland drain @ Rs. 10,000/- per Hectare with maintenance of Rs. 5,000/- per annum	28050	5000
	2. Progressive Closure Activity Barbed Wire Fencing to quarry area will be provisioned.	Per Hectare fencing Cost @ Rs. 2,00,000/- with Maintenance of Rs 10,000/- per annum	561000	10000
	3. Progressive Closure Activity Green belt development - 500 trees per one hectare - Proposal for 1620 Trees - (510 Inside Lease Area & 1110 Outside Lease Area)	Site clearance, preparation of land, digging of pits / trenches, soil amendments, transplantation of saplings @ 200 per plant (capital) for plantation inside the lease area and @ 30 per plant maintenance (recurring)	96000	14400
		Avenue Plantation @ 300 per plant (capital) for plantation outside the lease area and @ 30 per plant maintenance (recurring)	360000	36000
	4. Implementation of Final Mine Closure Actity as per Approved Mining Plan on Last Year	Few activities already covered as progressive closure activities as greenbelt development, wire fencing, garland drain. *For Final Closure Activities 15% of the proposed closure cost will be spent during the final mine closure stage - Last Year	67815	0
	5. Contribution towards Green Fund. As per TNMMCR 1959, Rule 35 A	The Contribution towards Green Funds @ 10% of Seigniorage fee are indicated as part of EMP Budge and not necessarily implemented in the Project Site	2336017	0

Implementation of EC, Mining Plan & DGMS Condition	Scientific Study Report for the blast induced ground vibration	Scientific Study report has been conducted for the Proposed blasting parameters to the project area, quarry, Separate Blasting Study will be conducted after starting the quarry	400000	0
	Size 6' X 5' with blue background and white letters as mentioned in MoM Appendix II by the SEAC TN	Fixed Display Board at the Quarry Entrance as permanent structure mentioning Environmental Conditions	10000	1000
	Air, Water, Noise and Soil Quality Sampling every 6 Months for Compliance Report of EC Conditions	Submission of 2 Half Yearly Compliance - Lab Monitoring Report as per CPCB norms	0	50000
	Workers will be provided with Personal Protective Equipment's	Provision of PPE @ Rs. 4000/- per employee with recurring based on wear and tear (say, @ Rs. 1000/- per employee) - 56 Employees	144000	36000
	Health check up for workers will be provisioned	IME & PME Health check up @ Rs. 1000/- per employee	0	36000
	First aid facility will be provided	Provision of 2 Kits per Hectare @ Rs. 2000/-	0	5610
	Mine will have safety precaution signages, boards.	Provision for signages and boards made	10000	2000
	No parking will be provided on the transport routes. Separate provision on the south side of the hill will be made for vehicles /HEMMs. Flaggers will be deployed for traffic management	Parking area with shelter and flags @ Rs. 50,000/- per hectare project and Rs. 10,000/- as maintenance cost	140250	10000
	Installation of CCTV cameras in the mines and mine entrance	Camera 4 Nos, DVR, Monitor with internet facility	30000	5000
	Implementation as per Mining Plan and ensure safe quarry working	Mines Manager (1st Class / 2nd Class / Mine Foreman) under regulation 34 / 34 (6) of MMR, 1961 and Mining Mate under regulation 116 of MMR,1961 @	0	780000

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		40,000/- for Manager & @ 25,000/- for Foreman / Mate		
CER	As per MoEF &CC OM 22-65/2017-IA.III Dated 25.02.2021	Detailed Description in following slides and Budget allocation is included as per MoeEF & CC OM	500000	0
TOTAL			**3492350**	**2249841**

Year Wise Break Up	
1st Year	₹ 57,42,191
2nd Year	₹ 23,62,333
3rd Year	₹ 24,80,450
4th Year	₹ 26,04,472
5th Year	₹ 27,34,696
Total	**₹ 159 lakhs**

In order to implement the environmental protection measures, an amount of Rs. 34.92 lakhs as capital cost and recurring cost as Rs. 22.49 lakhs as recurring cost is proposed considering present market price considering present market scenario for four proposed projects in the cluster.

10.10 CONCLUSION –

Various aspects of mining activities were considered and related impacts were evaluated. Considering all the possible ways to mitigate the environmental concerns Environmental Management Plan was prepared and fund has been allocated for the same. The EMP is dynamic, flexible and subjected to periodic review. For project where the major environmental impacts are associated, EMP will be under regular review. Senior Management responsible for the project will conduct a review of EMP and its implementation to ensure that the EMP remains effective and appropriate. Thus, the proper steps will be taken to accomplish all the goals mentioned in the EMP and the project will bring the positive impact in the study area.

11.   SUMMARY AND CONCLUSION

Tvl Navamani Mines Pvt Ltd Rough Stone & Gravel Cluster (Extent: 2.80.5ha) falls under "B" category as per MoEF & CC Notification (S.O. 3977 (E)).

Now, as per Order Dated: 04.09.2018 & 13.09.2018 passed by Hon'ble National Green Tribunal, New Delhi in O.A. No. 173 of 2018 & O.A. No, 186 of 2016 and MoEF & CC Office Memorandum F. No. L-11011/175/2018-IA-II (M) Dated: 12.12.2018 clarified the requirement for EIA/EMP and therefore, Public Consultation for all areas from 5 to 25 ha falling in Category B- 1 and appraised by SEAC/ SEIAA as well as for cluster situation.

A detailed Draft EIA EMP Report is prepared for public and other stakeholders' suggestions and a final EIA/EMP Report will be prepared based on the outcome of Public Consultation.

Environmental monitoring and audit mechanism have been recommended before and after commencement of the project, where necessary, to verify the accuracy of the EIA predictions and the effectiveness of recommended mitigation measures.

The main scope of the EIA study is to quantify the cumulative impact in the study area due to cluster quarries and formulate the effective mitigation measures for each individual leases. A detailed account of the emission sources, emissions control equipment, background Air quality levels, Meteorological measurements, Dispersion model and all other aspects of pollution like effluent discharge, Dust generation etc., have been discussed in this report. The baseline monitoring study has been carried out during the months March to May 2021 for various environmental components so as to assess the anticipated impacts of the cluster quarry projects on the environment and suitable mitigation measures for likely adverse impacts due to the proposed project is suggested individually for the respective proposed project under Chapter 10.

The project proponent ensures to obtain necessary clearances and quarrying will be carried out as per rules and regulations. The Mining Activity will be carried out in a phased manner as per the approved mining plan after obtaining EC, CTO from TNPCB, execution of lease deed and obtaining DGMS Permission and working will be carried out under the supervision of Competent Persons employed.

Overall, the EIA report has predicted that the project will comply with all environment standards and legislation after commencement of the project and operational stage mitigation measures are implemented.

Mining operations has positive impact on environment and socio economy such as landscape improvement, water as by-product, economy development and better public services, providing and supply of Rough Stone & Gravel as per market demand.

Sustainable and modern mining leads us to see positive impact of mining operation and providing consistent employment for nearly 36 people directly in the cluster and indirectly around 15 people.

As discussed, it is safe to say that the proposed quarries are not likely to cause any significant impact to the ecology of the area, as adequate preventive measures will be adopted to keep the various pollutants within the permissible limits. Green belt development around the area will also be taken up as an effective pollution mitigate technique, as well as to serve as biological indicators for the pollutants released from the Tvl Navamani Mines Pvt Ltd Rough Stone & Gravel Cluster (Extent: 2.80.5ha).

12.   DISCLOSURE OF CONSULTANTS

Tvl. Navamani Mines Private Limited have engaged M/s Geo Exploration and Mining Solutions, an Accredited Organization under Quality Council of India – National Accreditation Board for Education & Training, New Delhi, for carrying out the EIA Study as per the ToR Issued and Standard ToR Deemed Approved.

Name and address of the consultancy:

GEO EXPLORATION AND MINING SOLUTIONS
No 17, Advaitha Ashram Road,
Alagapuram, Salem – 636 004
Tamil Nadu, India
Email: infogeoexploration@gmail.com
Web: www.gemssalem.com
Phone: 0427 2431989.

The Accredited Experts and associated members who were engaged for this EIA study as given below –

Sl.No.	Name of the expert	In house/ Empanelled	EIA Coordinator		FAE	
			Sector	Category	Sector	Category
1	**Dr. M. Ifthikhar Ahmed**	**In-house**	**1**	**A**	WP GEO SC	B A A
2	Dr. P. Thangaraju	In-house	-	-	HG GEO	A A
3	Mr. A. Jagannathan	In-house	-	-	AP NV SHW	B A B
4	Mr. N. Senthilkumar	Empanelled	38 28	B B	AQ WP RH	B B A
5	Mrs. Jisha parameswaran	In-house	-	-	SW	B
6	Mr. Govindasamy	In-house	-	-	WP	B
7	Mrs. K. Anitha	In-house	-	-	SE	A
8	Mrs. Amirtham	In-house	-	-	EB	B
9	Mr. Alagappa Moses	Empanelled	-	-	EB	A
10	Mr. A. Allimuthu	In-house	-	-	LU	B
11	Mr. S. Pavel	Empanelled	-	-	RH	B
12	Mr. J. R. Vikram Krishna	Empanelled	-	-	SHW RH	A A

Abbreviations	
EC	EIA Coordinator
AEC	Associate EIA Coordinator
FAE	Functional Area Expert
FAA	Functional Area Associates
TM	Team Member
GEO	Geology
WP	Water pollution monitoring, prevention and control
AP	Air pollution monitoring, prevention and control
LU	Land Use
AQ	Meteorology, air quality modeling, and prediction
EB	Ecology and bio-diversity
NV	Noise and vibration
SE	Socio economics
HG	Hydrology, ground water and water conservation
SC	Soil conservation
RH	Risk assessment and hazard management
SHW	Solid and hazardous wastes
MSW	Municipal Solid Wastes
ISW	Industrial Solid Wastes
HW	Hazardous Wastes

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DECLARATION BY EXPERTS CONTRIBUTING TO THE EIA/EMP

Declaration by experts contributing to the EIA/EMP for Rough Stone & Gravel Cluster Quarries over an Extent of 8.80. ha in Sivayam (North) Village of Krishnarayapuram Taluk, Karur District of Tamil Nadu. It is also certified that information furnished in the above EIA study are true and correct to the best of our Knowledge.

I, hereby, certify that I was a part of the EIA team in the following capacity that developed the EIA/EMP Report.

Name**:**   **Dr. M. Ifthikhar Ahmed**

Designation**:**   **EIA Coordinator**

Date & Signature:
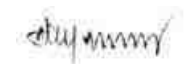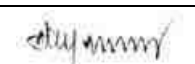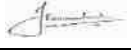
Period of Involvement: **May 2019 to till date**

Associated Team Member with EIA Coordinator:
1. **Mr. S. Nagamani**
2. **Mr. Viswathanan**
3. **Mr. Santhoshkumar**
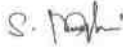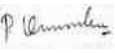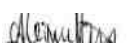
FUNCTIONAL AREA EXPERTS ENGAGED IN THE PROJECT
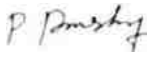
Sl. No.	Functional Area	Involvement	Name of the Expert/s	Signature
1	AP	▪ Identification of different sources of air pollution due to the proposed mine activity ▪ Prediction of air pollution and propose mitigation measures / control measures	Mr. A. Jagannathan	
2	WP	▪ Suggesting water treatment systems, drainage facilities	Dr. M. Ifthikhar Ahmed	
		▪ Evaluating probable impacts of effluent/waste water discharges into the receiving environment/water bodies and suggesting control measures.	Mr. N. Senthilkumar	
3	HG	▪ Interpretation of ground water table and predict impact and propose mitigation measures. ▪ Analysis and description of aquifer Characteristics	Dr. P. Thangaraju	
4	GEO	▪ Field Survey for assessing the regional and local geology of the area. ▪ Preparation of mineral and geological maps.	Dr. M. Ifthikhar Ahmed	
		▪ Geology and Geo morphological analysis/description and Stratigraphy/Lithology.	Dr. P. Thangaraju	
5	SE	▪ Revision in secondary data as per Census of India, 2011. ▪ Impact Assessment & Preventive Management Plan ▪ Corporate Environment Responsibility.	Mrs. K. Anitha	
6	EB	▪ Collection of Baseline data of Flora and Fauna. ▪ Identification of species labelled as Rare, Endangered and threatened as per IUCN list. ▪ Impact of the project on flora and fauna. ▪ Suggesting species for greenbelt development.	Mrs. Amirtham	
			Mr. Alagappa Moses	

7	RH	▪ Identification of hazards and hazardous substances ▪ Risks and consequences analysis ▪ Vulnerability assessment ▪ Preparation of Emergency Preparedness Plan ▪ Management plan for safety.	Mr. N. Senthilkumar	
			Mr. S. Pavel	
			Mr. J. R. Vikram Krishna	
8	LU	▪ Construction of Land use Map ▪ Impact of project on surrounding land use ▪ Suggesting post closure sustainable land use and mitigative measures.	Mr. A. Allimuthu	
9	NV	▪ Identify impacts due to noise and vibrations ▪ Suggesting appropriate mitigation measures for EMP.	Mr. A. Jagannathan	
10	AQ	▪ Identifying different source of emissions and propose predictions of incremental GLC using AERMOD. ▪ Recommending mitigations measures for EMP	Mr. N. Senthilkumar	
11	SC	▪ Assessing the impact on soil environment and proposed mitigation measures for soil conservation	Dr. M. Ifthikhar Ahmed	
12	SHW	▪ Identify source of generation of non-hazardous solid waste and hazardous waste. ▪ Suggesting measures for minimization of generation of waste and how it can be reused or recycled.	Mr. A. Jagannathan	
			Mr. J. R. Vikram Krishna	

LIST OF TEAM MEMBERS ENGAGED IN THIS PROJECT

Sl.No.	Name	Functional Area	Involvement	Signature
1	Mr. S. Nagamani	AP; GEO; AQ	▪ Site Visit with FAE ▪ Provide inputs & Assisting FAE with sources of Air Pollution, its impact and suggest control measures ▪ Provide inputs on Geological Aspects ▪ Analyse & provide inputs and assist FAE with meteorological data, emission estimation, AERMOD modelling and suggesting control measures	
2	Mr. Viswathanan	AP; WP; LU	▪ Site Visit with FAE ▪ Provide inputs & Assisting FAE with sources of Air Pollution, its impact and suggest control measures ▪ Assisting FAE on sources of water pollution, its impacts and suggest control measures ▪ Assisting FAE in preparation of land use maps	
3	Mr. Santhoshkumar	GEO; SC	▪ Site Visit with FAE ▪ Provide inputs on Geological Aspects ▪ Assist in Resources & Reserve Calculation and preparation of Production Plan & Conceptual Plan ▪ Provide inputs & Assisting FAE with soil conservation methods and identifying impacts	
4	Mr. Umamahesvaran	GEO	▪ Site Visit with FAE ▪ Provide inputs on Geological Aspects ▪ Assist in Resources & Reserve Calculation and preparation of Production Plan & Conceptual Plan	
5	Mr. A. Allimuthu	SE	▪ Site Visit with FAE ▪ Assist FAE with collection of data's ▪ Provide inputs by analysing primary and secondary data	

6	Mr. S. Ilavarasan	LU; SC	▪ Site Visit with FAE ▪ Assisting FAE in preparation of land use maps ▪ Provide inputs & Assisting FAE with soil conservation methods and identifying impacts	
7	Mr. E. Vadivel	HG	▪ Site Visit with FAE ▪ Assist FAE & provide inputs on aquifer characteristics, ground water level/table ▪ Assist with methods of ground water recharge and conduct pump test, flow rate	
8	Mr. D. Dinesh	NV	▪ Site Visit with FAE ▪ Assist FAE and provide inputs on impacts due to proposed mine activity and suggest mitigation measures ▪ Assist FAE with prediction modelling	
9	Mr. Panneer Selvam	EB	▪ Site Visit with FAE ▪ Assist FAE with collection of baseline data ▪ Provide inputs and assist with labelling of Flora and Fauna	
10	Mrs. Nathiya	EB	▪ Site Visit with FAE ▪ Assist FAE with collection of baseline data ▪ Provide inputs and assist with labelling of Flora and Fauna	

DECLARATION BY THE HEAD OF THE ACCREDITED CONSULTANT ORGANIZATION

I, Dr. M. Ifthikhar Ahmed, Managing Partner, Geo Exploration and Mining Solutions, hereby, confirm that the above mentioned Functional Area Experts and Team Members prepared the EIA/EMP for Rough Stone & Gravel Cluster Quarries over an Extent of 8.80.0 ha in Sivayam (North) Village of Krishnarayapuram Taluk, Karur District of Tamil Nadu. It is also certified that information furnished in the EIA study are true and correct to the best of our Knowledge.

Signature & Date:

Name: **Dr. M. Ifhikhar Ahmed**

Designation: **EIA Coordinator**

Name of the EIA Consultant Organization: **M/s. Geo Exploration and Mining Solutions**

NABET Certificate No & Issue Date: **NABET/EIA/2225/RA0276 Dated: 20.02.2023**
Validity: **Valid till 06.08.2025**