
DRAFT ENVIRONMENTAL IMPACT ASSESSMENT & ENVIRONMENTAL MANAGEMENT PLAN

FOR OBTAINING
Prior Environmental Clearance under EIA Notification – 2006
Schedule Sl. No. 1 (a) (i): Mining Project

NON-FOREST LAND/ GOVERNMENT LAND / FRESH MINE/ MINOR MINERAL/ 'B1' CATEGORY

VIRAHALUR SAND QUARRY (For Resorting the Functional Efficiency of Coleroon River)

| Project Proponent | Project Location |
|--|--|
| The Executive Engineer Water Resources Department Mining and Monitoring Division, Tiruchirappalli District, Tamil Nadu State - 620 020 | Virahalur Village, Lalgudi Taluk, Tiruchirapalli District S.F. No: 214(Part) and 235 (Part) |
| <u>PROJECT DETAIL</u> | |
| Extent | - 24.00.0 Ha |
| Total Mineable Reserves | - 7,68,000m ³ of Sand |
| Depth | - 3.2m (2.2m ABL + 1.0m BBL) |
| Proposed lease period | - Two years |

As per TOR vide

Lr No. SEIAA-TN/F.No.9282/SEAC/ToR-1226/2022 Dated: 22.08.2022

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Baseline Monitoring Season – December 2022 to February 2023

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(Approved by ISO/IEC 17025:2017)

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MAY 2023

LIST OF CONTENTS

| | |
|---|-----------|
| CHAPTER – 1: INTRODUCTION..... | 1 |
| 1.0 PREAMBLE | 1 |
| 1.1 PURPOSE OF THE REPORT..... | 1 |
| 1.2 IDENTIFICATION OF PROJECT AND PROJECT PROPONENT | 2 |
| 1.3 BRIEF DESCRIPTION OF THE PROJECT | 2 |
| 1.4 ENVIRONMENTAL CLEARANCE | 6 |
| 1.5 TERMS OF REFERENCE (ToR) | 7 |
| 1.6 POST ENVIRONMENT CLEARANCE MONITORING | 16 |
| 1.7 GENERIC STRUCTURE OF EIA DOCUMENT | 16 |
| 1.8 SCOPE OF THE STUDY | 17 |
| CHAPTER – 2: PROJECT DESCRIPTION | 18 |
| 2.0 GENERAL..... | 18 |
| 2.1 DESCRIPTION OF THE PROJECT..... | 18 |
| 2.2 LOCATION OF THE PROJECT..... | 18 |
| 2.3 GEOLOGY..... | 28 |
| 2.4 QUALITY OF RESERVE..... | 31 |
| 2.5 RESERVE ESTIMATION AND PRODUCTION | 31 |
| 2.6 METHOD OF MINING..... | 32 |
| 2.7 PROJECT REQUIREMENT | 34 |
| 2.8 PROJECT IMPLEMENTATION SCHEDULE..... | 35 |
| CHAPTER – 3: DESCRIPTION OF ENVIRONMENT..... | 36 |
| 3.0 GENERAL..... | 36 |
| 3.1 LAND ENVIRONMENT..... | 38 |
| 3.2 WATER ENVIRONMENT | 47 |
| 3.4 AIR ENVIRONMENT..... | 57 |
| 3.5 NOISE ENVIRONMENT..... | 66 |
| 3.6 BIOLOGICAL ENVIRONMENT..... | 69 |
| 3.7 SOCIO ECONOMIC ENVIRONMENT..... | 79 |
| 3.8 SUMMARY OF THE BASELINE STATUS: | 90 |
| CHAPTER – 4: ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES | 91 |
| 4.0 INTRODUCTION: -..... | 91 |
| 4.1 LAND ENVIRONMENT..... | 91 |
| 4.2 WATER ENVIRONMENT | 92 |

| | | |
|--|---|------------|
| 4.3 | <i>AIR ENVIRONMENT</i> | 92 |
| 4.5 | <i>NOISE ENVIRONMENT</i> | 98 |
| 4.6 | <i>BIOLOGICAL ENVIRONMENT</i> | 99 |
| 4.7 | <i>SOCIO ECONOMIC ENVIRONMENT</i> | 100 |
| 4.8 | <i>OCCUPATIONAL HEALTH RISKS</i> | 100 |
| CHAPTER – 5: ANALYSIS OF ALTERNATIVES (TECHNOLOGY AND SITE) | | 102 |
| 5.0 | <i>INTRODUCTION:</i> | 102 |
| 5.1 | <i>ANALYSIS OF ALTERNATIVE TECHNOLOGY</i> | 102 |
| CHAPTER – 6: ENVIRONMENTAL MONITORING PROGRAMME | | 103 |
| 6.0 | <i>INTRODUCTION</i> | 103 |
| 6.1 | <i>MEASUREMENT & METHODOLOGIES</i> | 103 |
| 6.2 | <i>MONITORING SCHEDULE AND FREQUENCY</i> | 103 |
| 6.3 | <i>IMPLEMENTATION SCHEDULE OF MITIGATION MEASURES</i> | 104 |
| 6.4 | <i>ENVIRONMENTAL MONITORING CELL</i> | 104 |
| 6.5 | <i>BUDGETARY PROVISION FOR ENVIRONMENTAL MONITORING</i> | 104 |
| 7. ADDITIONAL STUDIES | | 105 |
| 7.0 | <i>GENERAL</i> | 105 |
| 7.1 | <i>PUBLIC CONSULTATION</i> | 105 |
| 7.2 | <i>RISK ASSESSMENT</i> | 105 |
| 7.2 | <i>DISASTER MANAGEMENT PLAN</i> | 106 |
| 7.3 | <i>RECLAMATION AND REHABILITATION</i> | 107 |
| CHAPTER – 8: PROJECT BENEFITS | | 108 |
| 8.0 | <i>INTRODUCTION</i> | 108 |
| 8.1 | <i>PROJECT BENEFITS</i> | 108 |
| 8.2 | <i>BENEFITS TO LOCAL AND REGIONAL ECONOMY</i> | 109 |
| 8.3 | <i>EMPLOYMENT POTENTIAL</i> | 109 |
| 8.4 | <i>TANGIBLE SOCIAL BENEFITS</i> | 109 |
| CHAPTER – 9: ENVIRONMENTAL COST BENEFIT ANALYSIS..... | | 110 |
| CHAPTER - 10: ENVIRONMENTAL MANAGEMENT PLAN..... | | 111 |
| 10.0 | <i>GENERAL</i> | 111 |
| 10.1 | <i>LAND ENVIRONMENT MANAGEMENT</i> | 111 |
| 10.2 | <i>AIR ENVIRONMENT MANAGEMENT</i> | 111 |
| 10.3 | <i>NOISE AND VIBRATION MITIGATION:</i> | 112 |
| 10.3 | <i>WATER MANAGEMENT & POLLUTION CONTROL</i> | 112 |
| 10.4 | <i>LAND RECLAMATION AND WASTE MANAGEMENT</i> | 113 |

| | | |
|------|--|------------|
| 10.5 | <i>BIOLOGICAL ENVIRONMENT</i> | 113 |
| 10.9 | <i>OCCUPATIONAL SAFETY & HEALTH MANAGEMENT</i> | 114 |
| | CHAPTER – 11: SUMMARY AND CONCLUSIONS | 120 |
| | 12.0 DISCLOSURE OF CONSULTANTS ENGAGED | 121 |

LIST OF TABLES

| | |
|--|----|
| Table 1.1: Location of Project | 2 |
| Table 1.2: Salient features of the project site..... | 2 |
| Table 1.3: Resources and Reserves..... | 3 |
| Table 1.4: Compliance of ToR Conditions | 7 |
| Table 1.5: Structure of the EIA report | 16 |
| Table 1.6: Environment attributes | 17 |
| Table 2.1: Salient Features around the project area | 18 |
| Table 2.2: Boundary Co-Ordinates | 18 |
| Table 2.3: External infrastructures..... | 28 |
| Table 2.4: Mining details..... | 28 |
| Table 2.5: Resources and Reserves..... | 31 |
| Table 2.6: Year wise Production details | 31 |
| Table 2.7: Lists of Machineries Proposed..... | 32 |
| Table 2.8: Man power requirement..... | 32 |
| Table.2.9: Traffic Survey Locations | 34 |
| Table 2.10: Existing Traffic Volume | 34 |
| Table 2.11: Sand Hourly Transportation Requirement | 34 |
| Table 2.12: Summary of Traffic Volume | 34 |
| Table 2.13: Water Requirements | 34 |
| Table 2.14 Expected time schedule for the project | 35 |
| Table 2.15 Project cost | 35 |
| Table 3.1: Environmental monitoring attributes and frequency of monitoring | 37 |
| Table 3.2: Major land use/land cover of the study area | 38 |
| Table 3.3: Environmental Settings in the study area | 42 |
| Table 3.4: List of Water bodies near the project site | 42 |
| Table 3.4A: List of Water bodies near the project site | 42 |
| Table 3.5 – Soil Sampling Locations..... | 43 |

| | |
|--|----|
| Table 3.6 – Methodology of Sampling Collection..... | 43 |
| Table 3.7: Soil sampling results..... | 46 |
| Table 3.8: Details of Bore well in 2km Radius..... | 47 |
| Table 3.9 – Water Sampling Locations | 49 |
| Table 3.10 – Surface Water Analysis Results..... | 53 |
| Table 3.11 – Ground Water Analysis Results..... | 54 |
| Table 3.12 – Rainfall Data..... | 57 |
| Table 3.14 – Methodology and Instrument Used for Air Quality Analysis | 59 |
| Table 3.15 – National Ambient Air Quality Standards..... | 59 |
| Table 3.16 – Ambient Air Quality (AAQ) Monitoring Locations | 60 |
| Table 3.17: Abstract of Ambient Air Quality Data..... | 62 |
| table 3.18– Fugitive Dust sample values in $\mu\text{g}/\text{m}^3$ | 65 |
| Table 3.19 – Details of Surface Noise Monitoring Locations | 66 |
| Table 3.20 – Noise Monitoring Results in Core and Buffer Zone | 68 |
| Table 3.21 : Flora in the Core zone of lease area (Kollidam River bed) VirahalurVillage..... | 70 |
| Table 3.22 : List of Flora in the Buffer Zone..... | 73 |
| Table 3.23 : List of Fauna in the Core Zone | 75 |
| Table 3.24: List of Fauna’s in the buffer zone | 76 |
| Table 3.25.Shows the socio-economic profile of the study area as compared to district, state and national level socio-economic profile | 80 |
| Table 3.26 Total Population of Study Area | 81 |
| Table 3.27 Population Projection of Study Area | 81 |
| Table 3.28. Zone wise Demographic Profile of Study Area | 82 |
| Table 3.29 : List of Villages, Demography details within the study area | 83 |
| Table 3.30. Literacy Rate of the Study Area | 85 |
| Table 3.31 vulnerable groups of the study area | 86 |
| Table 3.32 shows the work force of the study area..... | 87 |
| Table 4.1: Water Requirements | 92 |

| | |
|---|-----|
| Table 4.2: Incremental & Resultant GLC of PM ₁₀ | 95 |
| Table 4.3: Incremental & Resultant GLC of PM _{2.5} | 96 |
| Table 4.4: Incremental & Resultant GLC of SO ₂ | 96 |
| Table 4.5: Incremental & Resultant GLC of NO _x | 96 |
| Table 4.6: Incremental & Resultant GLC of Fugitive dust..... | 97 |
| Table 4.7: Anticipated Noise levels..... | 98 |
| Table 6.1: Monitoring Schedule | 103 |
| Table 6.2: Environment Monitoring Budget..... | 104 |
| Table 7.1 Risk Assessment & Control Measures..... | 105 |
| Table 10.1: Air pollution management and control | 111 |
| Table 10.2: Noise and Vibration Mitigation..... | 112 |
| Table 10.3 Proposed Greenbelt Activities For 2 Year Plan Period..... | 114 |
| Table 10.4: Recommended Species to Plant in the Greenbelt | 114 |
| Table 10.5: Medical Examination Schedule | 115 |
| Table 10.6: List of Periodical Trainings Proposed For Employees | 117 |
| Table 10.7: EMB Budget..... | 118 |
| Table 12.1: Details of Experts involved in the project | 121 |

LIST OF FIGURES

| | |
|---|----|
| Figure 1.1: Key Map - Location of the Project Site..... | 4 |
| Figure 1.2: Toposheet showing Location of the Project Site & 10km Radius | 5 |
| Figure 2.1: Digitized location map covering 10 km radius..... | 19 |
| Figure 2.2: Digitized location map covering 5 km radius..... | 20 |
| Figure 2.3: Location map on the geo referenced Toposheet (2km radius) | 21 |
| Figure 2.4: Digitized location map covering 1km radius..... | 22 |
| Figure 2.5: Quarry Boundary superimposed on Satellite Imagery | 23 |
| Figure 2.6: Google Earth Image showing 300 and 500m radius from Project area | 24 |
| Figure 2.7: Topographical view of the project area | 25 |
| Figure 2.8: Topography, Geological and Environment Management Plan..... | 26 |
| Figure 2.9: Surface, Geological and Yearwise development Plan and Sections..... | 27 |
| Figure 2.10: Geology map of the area | 29 |
| Figure 2.11: Geomorphology map of the area | 30 |
| Figure.2.12: Mineral Transportation route map..... | 33 |
| Figure 3.1: Physiography Map of the study area | 39 |
| Figure 3.2: Land use – Land cover map of the study area | 40 |
| Figure 3.3: Pie diagram – land use land cover..... | 41 |
| Figure 3.4: Soil Sampling Locations around 10 km radius..... | 44 |
| Figure 3.5: Soil Map of the study area..... | 45 |
| Figure 3.6: Winter Season Water Level of Bore Wells 2 Km Radius | 48 |
| Figure 3.7: Water quality monitoring stations around 10km radius | 50 |
| Figure 3.8: Ground Water Level Map | 51 |
| Figure 3.9: Drainage map of the study area - 10km radius | 52 |
| Figure 3.10: Windrose Diagram | 58 |
| Figure 3.11: Ambient Air Quality Monitoring Location Map | 61 |
| Figure 3.12: Bar Diagram - Particulate Matter (PM ₁₀) and (PM _{2.5})..... | 62 |
| Figure 3.13: Bar Diagram - Sulphur dioxide (SO ₂) and (NO ₂)..... | 63 |

| | |
|--|-----|
| Figure 3.14: Noise Level monitoring Location Map | 67 |
| Figure 3.15: Day & Night Time Noise Levels in Core and Buffer Zone..... | 68 |
| Fig No: 3.16. Flora species observation in the Core zone area..... | 71 |
| Fig 3.17 Graph Showing Population Projection | 81 |
| Figure 3.19 Gender wise Literacy Rate in the study area | 85 |
| Figure 3.20 vulnerable groups | 86 |
| Figure 3.21 Working population in the study area | 88 |
| Figure 4.1: AERMOD Terrain Map | 93 |
| Figure 4.2: Predicted Incremental Concentration of PM ₁₀ | 93 |
| Figure 4.3: Predicted Incremental Concentration of PM _{2.5} | 94 |
| Figure 4.4: Predicted Incremental Concentration of SO ₂ | 94 |
| Figure 4.5: Predicted Incremental Concentration of NO _x | 94 |
| Figure 4.6: Predicted Incremental Concentration of Fugitive Dust | 95 |
| Figure 10.1: Personal Protective Equipment to the Mine Workers | 116 |

CHAPTER – 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.

Whenever floods and consequent damages occurred it was resorted to increase the bund level to restore the carrying capacity of river. It was never thought of quarrying river due to the enormous cost, it requires and the problem of ways and means to dispose the desilted sand. Consequence of this Change in river regime and reduction in carrying capacity of the Coleroon river, the shoals in the rivers, divert the flow of water resulting in bund erosion and consequent breaches, which lead to loss of property and lives.

Solution to the above problem is to desilt the sand and shoals in Coleroon River by expending huge amount. Alternatively, the economical solution to this problem is to quarry the sand to remove the shoals. This option would not yield net revenue to the state Exchequer apart from making available the important construction material for infrastructure development at a reasonable price to the common people.

The project proponent, Executive Engineer, Water Resources Department, Mining and Monitoring division applied for Sand quarry lease over an extent of 24.00.0 Ha in Virahalur Village, Lalgudi Taluk, Tiruchirapalli District, Tamil Nadu. The application was processed by the Department of Geology and Mining, Tiruchirapalli and passed precise area communication letter vide Rc.No 698/2021/Mines, dated 22.02.2022 to obtain Mining plan and Environmental Clearance from the SEIAA, Tamil Nadu. The mining plan was prepared and got approval from the Assistant Director, Department of Geology and Mining, Tiruchirapalli vide Rc.No 698/2021/Mines, Dated 12.05.2022.

The proponent has obtained necessary statutory clearances from the Department of Geology and Mining, Tiruchirapalli District, Tamil Nadu (Statutory Clearance Documents are enclosed along with Mining plan as Annexure No III).

Proponent applied for ToR for Environmental Clearance to SEIAA, Tamil Nadu and obtained ToR vide letter no. SEIAA-TN/F.No.9282/SEAC/ToR-1226/2022 Dated: 22.08.2022 for carrying out EIA and EMP studies.

The proponent has engaged M/s. Geo Exploration and Mining Solutions, Salem, Tamil Nadu for carrying out EIA / EMP Study. The Baseline Monitoring study has been carried out during winter season (December 2022 to February 2023). This EIA Report is prepared in compliance with ToR obtained vide Lr No. SEIAA-TN/F.No. 9282/SEAC/ToR-1226/2022 Dated: 22.08.2022.

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 14th August 2018, Mining Projects are classified under two categories i.e., A (> 100 Ha) and B (\leq 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.

Now, as per Gazette Notification S.O. 1886 (E) of 20th April 2022, Mining Projects are classified under two categories i.e. A (>250 Ha) and B (\leq 250 Ha),

“All mining lease area in respect of minor mineral mining leases and ≤ 250 ha mining lease area in respect of major mineral mining lease other than coal”

The proposed project is categorized under category “B1” Activity 1(a) (Total Extent of the area is >5 Ha) and will be considered at SEIAA – TN after conducting Public Hearing and Submission of EIA/EMP Report for Grant of Environmental Clearance.

“Draft EIA report prepared on the basis of ToR Issued for carrying out public hearing for the grant of Environmental Clearance from SEIAA, Tamil Nadu”

1.2 IDENTIFICATION OF PROJECT AND PROJECT PROPONENT

1.2.1 Identification of Project & Project Proponent

Table 1.1: Location of Project

| Name and Location of the project | Project proponent address |
|---|--|
| Virahalur Sand Quarry S.F.Nos.214Part) & 234 (Part), Virahalur Village, Lalgudi Taluk, Tiruchirappalli District, Tamil Nadu state | The Executive Engineering, Water Resource Department, Mining and Monitoring Division, Tiruchirappalli – 620 020 |

1.3 BRIEF DESCRIPTION OF THE PROJECT

Table 1.2: Salient features of the project site

| DESCRIPTION | DETAILS | |
|--|--|------------------------|
| Name of the project | Virahalur Sand Quarry | |
| Name of Mineral | Sand | |
| S.F. No's and Village | S.F.Nos. 214Part) & 234 (Part), Virahalur Village | |
| Extent | 24.00.0 ha | |
| Classification of Land | Government Land Water Resource Department, Mining and Monitoring Division, Tiruchirappalli | |
| Taluk | Lalgudi | |
| District | Tiruchirappalli | |
| State | Tamil Nadu | |
| Latitude Between | 10°53'53.3283"N to 10°54'01.5626"N | |
| Longitude Between | 78°58'21.6578"E to 78°59'01.4184"E | |
| Toposheet No | 58- J/13 | |
| Topography of the area | The topography of the area is almost plain topography with shoals of Sands having gentle slope towards East side. Highest Elevation between: 43.35m to 48.07m AMSL | |
| Life of Mine | 2 years | |
| Geological Reserves | 12,00,000m ³ of Sand | |
| Mineable Reserves | 7,68,000m ³ of Sand | |
| Yearwise Production (2 Years) | 1 st Year | 3,60,000m ³ |
| | 2 nd Year | 4,08,000m ³ |
| Mining Method | Opencast Mechanized Method of Mining without Drilling and Blasting | |
| Proposed depth of mining for this plan period | 3.2m (2.2m abl + 1.0m bbl) | |
| Ultimate Pit Dimension | 1200m (Length) X 200m X 3.2m (Depth) (2.2m abl + 1.0m bbl) | |
| Employment Potential | 40 Nos | |
| Ground Water table | 12 m BGL | |
| Ground Water Table Intersection | Quarrying operation will be carried out well above the ground water table, hence ground water will not be affected by proposed mining. | |
| Drainage Pattern | The drainage pattern of the area is dendritic. | |
| Water Requirement & Source | Total water requirement for dust suppression, Greenbelt and drinking is 3.0 KLD. Water will be sourced from nearby villages by water tankers and drinking water will be sourced from approved water vendors. | |
| 500m Radius Letter from the Assistant Director, Tiruchirappalli District | Existing Quarry | - Nil |
| | Expired/Abandoned Quarries | - Nil |
| | Proposed Quarry | - 1 No (24.00.0ha) |
| Project Cost | Rs 1,35,60,000 /- | |

Source: Approved Mining Plan

1.3.1 Nature and Size of Project

The Sand deposit is proposed to be excavated by deploying Hydraulic Excavator. No drilling and Blasting are involved in this quarry operation, since the deposit is soft and fragile in nature. The quarrying operations involve removal of Sand using hydraulic excavator by opencast mechanized mining method. Sand will be transported by 10/20 Tonnes capacity to the needy customers.

Resources and Reserves are calculated in Cross Section method after leaving necessary safety distance and bench loss.

Table 1.3: Resources and Reserves

| Description | ROM in m ³ |
|----------------------|-----------------------|
| Geological Resources | 12,00,000 |
| Mineable Reserves | 7,68,000 |
| Year-wise production | 7,68,000 |

Source: Approved Mining Plan

1.3.2 Need for the Project

- * To enhance the Functional Efficiency of the Coleroon River

Importance for the Region (Study Area)

- * This project will enhance the Functional efficiency of the river flow, through this, floods are protected from entering the nearby Village during rainy season
- * This Project will help to reduce demand and supply gap to the Construction industries.

1.3.3 Location of the Project

- * The area lies between the Latitude of 10°53'53.3283"N to 10°54'01.5626"N and Longitude of 78°58'21.6578"E to 78°59'01.4184"E and marked in the Survey of India, Toposheet No. 58- J/13.

Figure 1.1: Key Map - Location of the Project Site

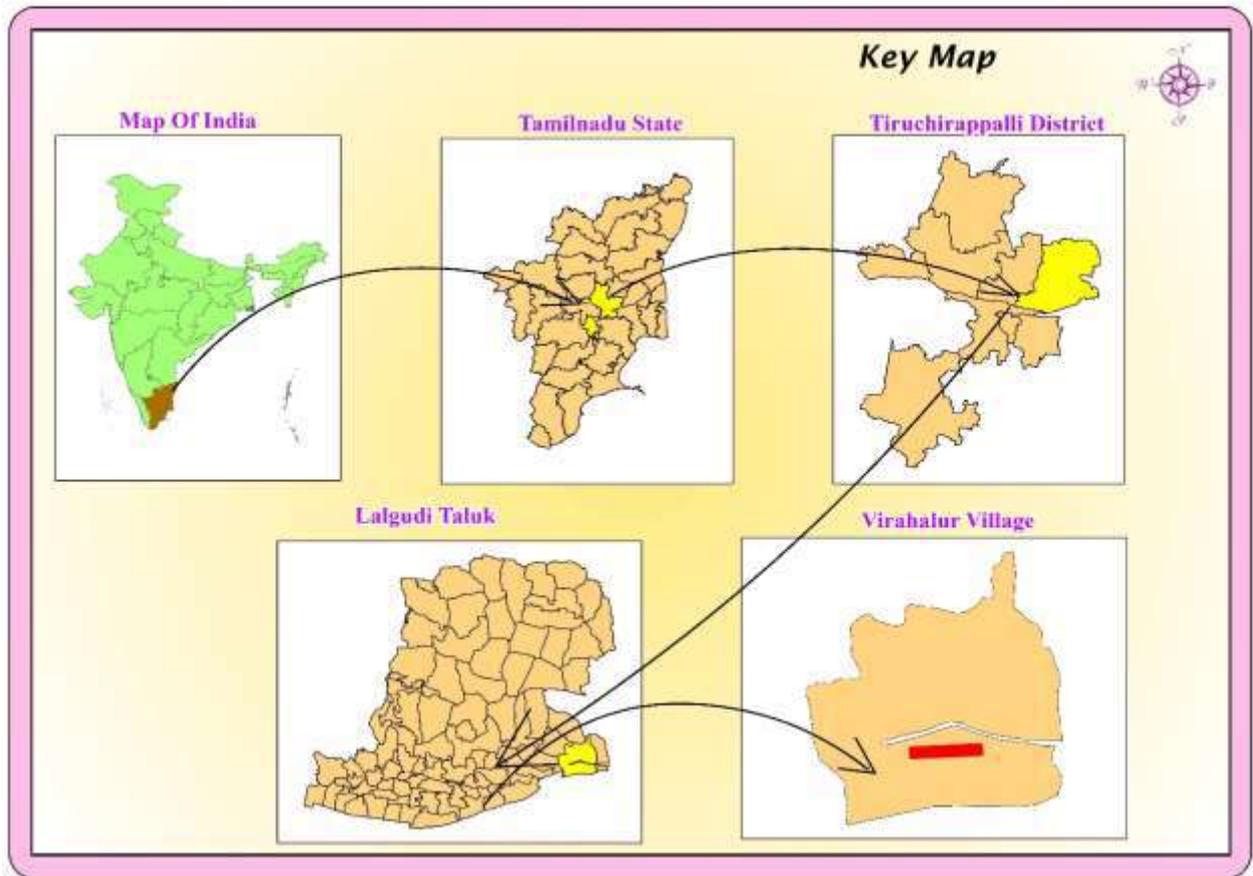
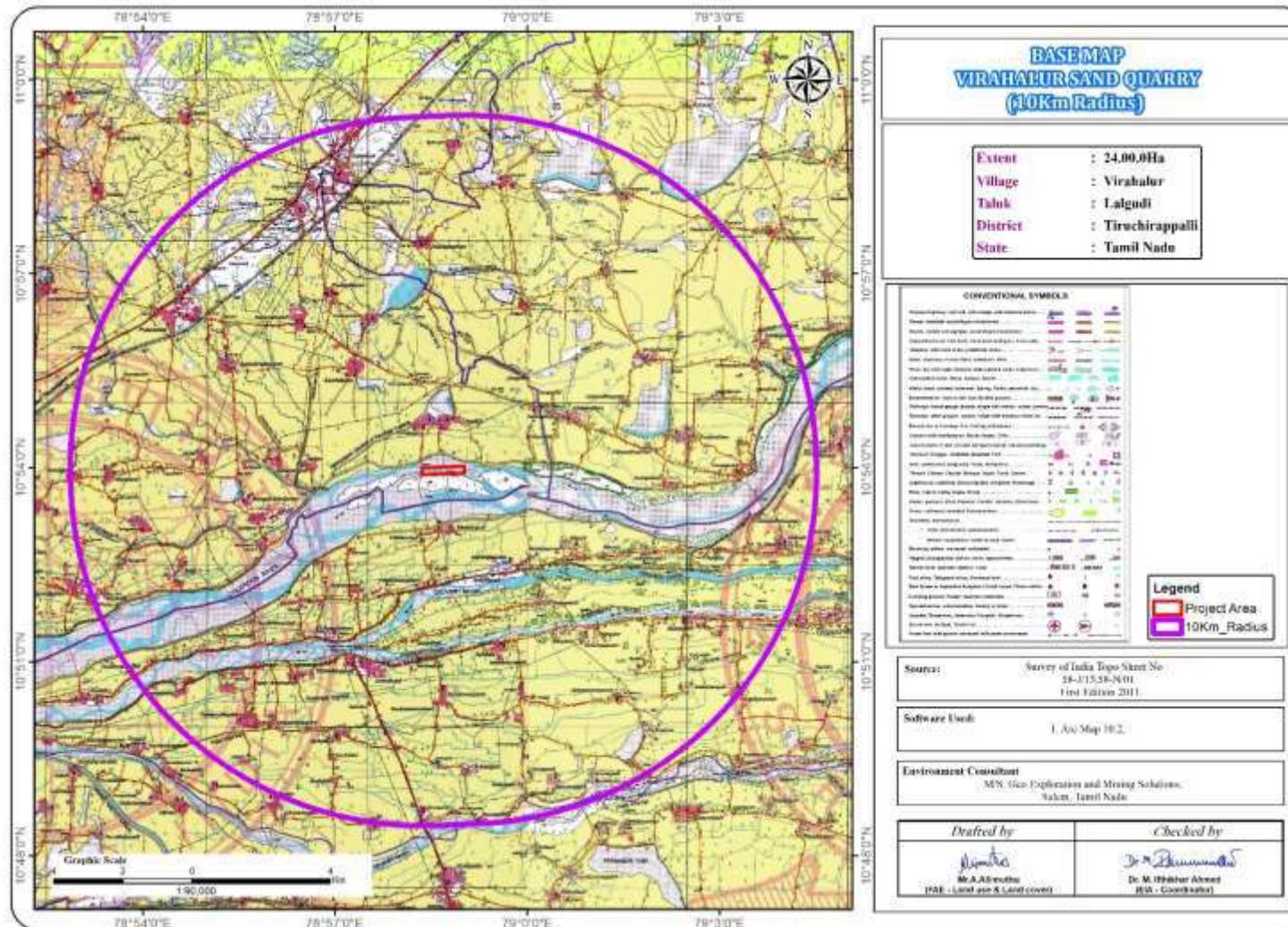


Figure 1.2: Toposheet showing Location of the Project Site & 10km Radius



1.4 ENVIRONMENTAL CLEARANCE

The Proponent applied for ToR for Prior Environmental Clearance vide online Proposal No.SIA/TN/MIN/ 77360/2022 dated: 27.05.2022

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: -

- * Precise Area Communication letter issued by District Collector, Tiruchirapalli vide Letter No. 698/2021/Mines Dated 22.02.2022 for preparation of Mining Plan and for Obtaining Prior-Environmental Clearance.
- * The Mining Plan was prepared under Rule 41 & 42 of Tamil Nadu Minor Mineral Concession Rules, 1959 and the approved by Deputy Director of Geology and Mining, Tiruchirapalli District vide Letter No: 698/2021/Mines Dated 12.05.2022
- * The proposed project falls under “B1” Category 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

The proponent applied for ToR for Prior Environmental Clearance vide online Proposal No. No.SIA/TN/MIN// 77360/2022 dated: 27.05.2022

Scoping: -

- * The proposal was placed in 296th SEAC meeting held on 16.07.2022 and the committee recommended for issue of ToR
- * The proposal was considered in 541st SEIAA meeting held on 22.08.2022 and issued ToR vide Letter No SEIAA-TN/F.No. 9282/SEAC/ToR-1226/2022 Dated 22.08.2022

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 Draft EIA/ EMP Report and the outcome of public hearing proceedings will be detailed in the Final EIA/EMP Report.

Appraisal:-

Appraisal means 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 company to the regulatory authority concerned for grant of environmental clearance.

The report has been prepared using the following references:

- * EIA Notification, 14th September, 2006
- * Guidance Manual of Environmental Impact Assessment for Mining of Minerals, Ministry of Environment and Forests, 2010
- * ToR Letter No. SEIAA-TN/F.No. 9282/SEAC/ToR-1226/2022 Dated 22.08.2022
- * Approved Mining Plan vide letter No. 698/2021/Mines Dated 12.05.2022. In addition, other relevant standards for individual activities such as sampling and testing of environmental attributes have been followed.

1.5 TERMS OF REFERENCE (ToR)

“ToR issued vide Letter No. SEIAA-TN/F.No. 9282/SEAC/ToR-1226/2022 Dated 22.08.2022”

Table 1.4: Compliance of ToR Conditions

| SPECIFIC CONDITIONS | | |
|----------------------------|--|---|
| 1 | The project proponent shall study and report in details of the “Replenishment study” as per Sustainable Sand Mining Management Guidelines, 2016 and Enforcement & Monitoring Guidelines for sand Mining 2020. | Noted and agreed. |
| 2 | The PP shall carry out the study on drinking water scheme in 5km, either side of the bank of the river and the same shall be included in the EIA report. | Noted and agreed |
| 3 | <p>The details of the location to cover land use and ecologically sensitive areas</p> <p>a. Details of the open wells, bore wells, and other surface water bodies including the details of ground water levels, Quantity in the 500m radius from the boundary of the mine lease area</p> <p>b. Impacts of this mining activity in the above said water bodies in the 500m radius from the boundary of the mine lease area</p> <p>c. Thickness of Sand and its variation covering the entire area; similarly the width of the sand bed, quantification of the shoal formation in that area</p> <p>d. Agricultural land if any, surrounding the quarry site</p> <p>e. Details of longitudinal and cross section of the river bed in the proposed mining area</p> <p>f. Details of earlier of mining carried out in the 500m radius of the mine lease area including the location, quantity of sand mined out, depth of the mining, etc., shall be furnished.</p> | <p>a. There are 6 Numbers of borewell within the radius of 2.0km from the boundary of the mine lease area. Details of the bore wells given in the Chapter No.3 Page No.47</p> <p>b. Impacts of the water bodies and mitigation measure described in the Chapter No..4 Page No.91</p> <p>c. The thickness of the sand deposit is varying from 0.5m to maximum 5m inclusive of shoals. The average depth of the mining is estimated as 3.2m (2.2m abg + 1.0m bgl).</p> <p>d. The area is surrounded by Coleroon river and details of agriculture land in the study area described in Chapter No.3,Page No.41</p> <p>e. The length of the longitudinal section is 1200m and the width of the sections is 200m.</p> <ul style="list-style-type: none"> There are no mining activities earlier within 500m radius of the mine lease area. |
| 4 | Reclamation of Sand area after mining needs to be submitted | The land will be getting natural reclamation during the rainy seasons. |
| 5 | Adequate plan for traffic management as per the Guidelines for Sustainable Sand mining issued in 2016 by the MoEF & CC, GOI, New Delhi for the loaded vehicles passing through nearby habitation. | Details traffic study is given in the Chapter No.2 Page No.33 |
| 6 | The PWD has to furnish the details regarding agricultural activities that are taking place around the project area. | Details of the agriculture land near the project area is given in the Chapter No.3 Page No.38, Figure No.3.2 |
| 7 | Details of the Structures available within 1k from the mine lease area boundary (both upstream and downstream and also study the Impact of Sand mining o the structures located in the said area. | Structures map around the project area within 1km both upstream and downstream is given in the Chapter No.3 Page No.42 |
| 8 | The Route map for the lorries for accessing the project area and for transporting mined sand should be specified | Transportation route map for accessing the project area is given in the Chapter No.2 Page No.33 Figure No.2.12 |
| 9 | Suitable working methodology to prevent dust pollution needs to be prepared taking wind direction into consideration | The predominant wind direction in the area is South West to North East direction. The working methodology is given in the Chapter No.2 Page No.32 |
| 10 | The mining area must be demarcated leaving at least 50m from the river embankment on either side | The project area was demarcated after leaving 50m from the river embankment on either side. |
| 11 | Wherever irrigation channels take off from the river | No irrigation channels within the mining project area |

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| | within the boundary of the mining project, the mining operation should not affected the flow of water in the irrigation Channels. In such a way a plan of action should be submitted. | boundary. |
| 12 | EMP should contain break up details such as tools, labor and environmental monitoring cost, cost for the ground water monitoring in the surrounding area shall be part of the EMP cost, variation of depth of ground water and quality shall be monitored during the project period by conducting survey once in 3 months. This cost shall also be included in EMP. | Break up details for the monitoring cost included in the EMP cost. Detailed EMP cost given in the Chapter No.2 Table No.2.15. Page No. 35 |
| 13 | Since there are many proposals for sand mining under the River Coleroon. It is necessary to model the overall impact on sand mining on regional Ground water. | Noted and agreed. |
| 14 | <p>The proposal for CER shall be furnished with time frame as per the Office Memorandum of MoEF & CC dated 01.05.2018</p> <p>a. The following details also included in the EIA report quantity estimated to be mined through machineries & manual mining with extent</p> <p>b. Certificate from the VAO stating the details of habitation located within 300m radius from the boundary of the proposed site along with FMB sketch</p> <p>c. The project proponent has to furnish the affidavit stating there are no bridges, culverts, cross masonries, water head works or any other civil structures within 500mts., of the proposed quarry site.</p> <p>d. The RL upstream, RL Downstream, RL starting, RL Ending, Chainage Starting Km, Ending Km Details shall be furnished.</p> <p>e. Geological sections map should be furnished</p> <p>f. 500m, 1Km & 5Km radius of Clear Google Map showing all the features like agricultural activities, habitations.</p> | <p>Certificate from the VAO stating habitation details within the radius of 300m is enclosed as Annexure No.IIA</p> <p>Affidavit stating there are no bridges, culverts, cross masonries, water head works and civil structures details within 500m radius from the proposed project site is enclosed as Annexure No.II</p> <p>Upstream RL – 46.80m Downstream RL – 44.47m Starting Chainage – 45+170m Ending Chainage – 46+370m</p> <p>Geological plan and section is enclosed as Plate No IIB along with Mining plan. Google map showing agriculture activities and habitation within 500m, 1Km and 5 Km Radius is enclosed with this EIA report.</p> |
| Additional Conditions | | |
| 1 | As per the MoEF& CC office memorandum F.No.22-65/2017-IA.III dated: 30.09.2020 and 20.10.2020 the proponent shall address the concerns raised during the public consultation and all the activities proposed shall be part of the Environment Management Plan | Noted and agreed |
| 2 | The Project Proponent shall study and report in detail the following, as provided in Sustainable Sand Mining Management Guidelines, 2016 and Enforcement and Monitoring Guidelines for Sand mining, MoEF & CC 2020 | Noted and agreed |
| 3 | Furnish the details with route map and the transportation route | Transportation route details along with map detailed in Chapter No.2. Figure No.2.12 Page No.33 |
| 4 | The details of maximum production from the mines | The mining operation is proposed to carry out for the period of two years the peak production capacity in the mine is 4,08,000m ³ (2 nd year). |
| 5 | Demarcation of mining area with pillars and georeferencing shall be made by furnishing photographs taken on site prior to the start of mining. | Noted and agreed. |
| 6 | The Environmental Impact Assessment shall study in detail the carbon emission and also suggest the measures | Carbon emission is only due to the using Excavators and tippers. Greenbelt development will be carried |

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| | to mitigate carbon emission including development of Carbon sinks and temperature reduction including control of other emission and Climate mitigation activities. | out in the river bank and Village roads to reduce Carbon emission. |
| 7 | The Environmental Impact Assessment should study the biodiversity, the natural ecosystem, the soil micro flora, fauna and soil seed banks and suggest measures to maintain the natural Ecosystem | Detailed biological study of the study area [core zone and buffer zone (10 km radius of the periphery of the mine lease)] was carried out and discussed under Chapter No. 3, Page No. 68. There is no schedule I species of animals observed within study area as per Wildlife Protection Act 1972 as well as no species is in vulnerable, endangered or threatened category as per IUCN. There is no endangered red list species found in the study area. |
| 8 | Action should specifically be suggested for sustainable management of the area and restoration of ecosystem for flow of goods and services. | Noted and agreed |
| 9 | The project proponent shall study impact on indigenous flora and fauna. | Discussed in chapter no.3, page no.68-77 |
| 10 | The project proponent shall study impact on fish habitats and the food web/ food chain in the water body and Reservoir. | The mining operation will be carried out without drilling and blasting and the excavation will be carried out only in non-flow of water in the river. Study of impact on fish habitats and food web. Food chain is described in the Chapter No.3 Page No.77 |
| 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 a New Proposal for Quarrying of Sand and silt over an extent of 24.00.0 ha. |
| 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 Precise area communication letter granted in the name of Lessee, The Executive Engineer, Water Resource Department, Mining and Monitoring Division. |
| 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. | The project area, production levels, method of mining etc., are compatible with all documents including approved mine plan & Draft EIA/EMP Report and is in the name of project proponent. |
| 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 Chapter No.2, Figure No. 2.5 page No. 23 Project area boundary coordinates superimposed on Toposheet – Figure No. 2.3, Page No. 21 Toposheet of the project area covering 10km radius – Figure No. 2.1, Page No. 19 Geomorphology of the project area covering 10km radius - Figure No. 2.11, Page No. 30 Geology map of the project area covering 10km radius - Figure No. 2.10, Page No. 29 |
| 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. 2.11, Page No. 30 |

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| 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 proposed project area conforms to the land use policy of the state and necessary permissions concerned authorities are obtained before grant of Precise Area Communication Letter and Mining Plan is Approved by Assistant Director, Department of Geology and Mining, Tiruchirapalli. |
| 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. | The project proponent is the Government organization, Separate Division has been formed in the name of Mining and Monitoring Division in Water Resource Department. The proponent has framed its Environmental Policy. The Approved copy of Environmental Policy is discussed as Chapter No.6 The detailed operating process, hierarchical system and compliance monitoring is discussed in Chapter No. 6, Page No. 101 |
| 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. | Not applicable the mining operation will be carried out without drilling and blasting upto the depth of 3.2m (average). |
| 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. | The EIA Study Area considered for this project is 10 km radius from the Project Area. All the production and waste generation details discussed in the EIA/ EMP report is for the entire life of the mine. |
| 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 land cover of the study area covering 10 km radius from the project site was studied using BHUVAN and LU/LC classification map has been prepared delineating Forest area, Agricultural land, Grazing land, Wildlife sanctuary, National park, Migratory routes of fauna, Water bodies, Human settlements and other Ecological features. Details are discussed in Chapter No. 3, Table No 3.2, Figure No.3.3, Page Nos. 38, 41. |
| 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 No waste anticipated from this mining project as the entire mined out Sand and silt Mining. |
| 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 Project Area. |
| 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 | Not Applicable There is no Forest Land involved in the Project Area. |

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| | afforestation (CA) should be indicated. A copy of the forestry clearance should also be furnished. | |
| 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. | Not Applicable There is no Forest Land involved in the Project Area. |
| 15. | The vegetation in the RF / PF areas in the study area, with necessary details, should be given. | The details of vegetation are given in the Chapter No.3, Page No. 42 |
| 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 Schedule I species observed within study area as per Wildlife Protection Act 1972 as well as no species is in vulnerable, endangered or threatened category as per IUCN. There is no endangered red list species found in the study area. |
| 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 are No National parks, Sanctuaries, Biosphere reserves, Wildlife Corridors, Ramsar site Tiger/ Elephant Reserves/ (existing as well as proposed) within 10 km of the project 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 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. | The Ecology and Biodiversity study was carried out for 10 km radius from the project area and the details of the flora and fauna are detailed in Chapter No. 3, Page No. 68-77. There is no other Schedule I species observed within study area as per Wildlife Protection Act 1972 as well as no species is in vulnerable, endangered or threatened category as per IUCN. There is no endangered red list species found in the study area. |
| 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. | Not Applicable. No Critically Polluted Areas within a radius of 10 km from project area. |
| 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 doesn't attract CRZ Notification. |
| 21. | R&R Plan/compensation details for the Project Affected | The project area over an extent of 24.00.0 ha in |

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| | <p>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 program prepared and submitted accordingly, integrating the sectoral program 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.</p> | <p>Virahalur is a Government Land classified as Coleroon River and there is no habitation within a radius of 300 meters from the proposed project area. Therefore, R&R Plan / Compensation details for the Project Affected People (PAP) is not anticipated and Not Applicable for this project.</p> |
| 22. | <p>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.</p> | <p>Baseline Data Collection for one season (winter Season) December 2022 to February 2023 is collected for various environmental attributes like Air, Water, Noise and Soil, Details of flora and fauna & meteorological data are as well collected and incorporated under Chapter No. 3.</p> <p>One monitoring station within 500m of the project area in the pre-dominant downwind direction is monitored and the mineralogical composition of free silica is discussed in Chapter No. 3.0,</p> |
| 23. | <p>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 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.</p> | <p>Air quality modeling was carried out using AERMOD to predict the incremental concentration due to the proposed mining activities and transportation of mineral. The particulate matter concentration is well within the prescribed limits as per CPCB norms, details in Chapter No. 4, Page No. 91-95</p> <p>The air quality contour is also prepared indicating the location of sensitive receptors, mining site, habitations etc., and wind rose is plotted showing pre dominant down wind direction.</p> |
| 24. | <p>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.</p> | <p>The total Water Requirement is 3.0 KLD, utilization and sources of water is discussed in the Chapter No.2, Table No.2.13, Page No. 34</p> |
| 25. | <p>Necessary clearance from the Competent Authority for drawl of requisite quantity of water for the Project should be provided.</p> | <p>The water will be sourced from the nearby water vendors through water tankers and no additional permissions are required.</p> <p>No water is withdrawn for the mining operations nor involving for quarrying activity.</p> |
| 26. | <p>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.</p> | <p>In this mining operation water will not be utilized for mining purpose.</p> <p>The main aim of the project is enhance the functional efficiency of the Coleroon river.</p> |
| 27. | <p>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.</p> | <p>No Negative impacts are anticipated on surface water quality.</p> <p>The depth of quarrying is proposed upto 3.2m, which is well above the water table.</p> |

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| | | Mitigations measures to maintain the surface water & ground water quality are discussed in Chapter No. 4, Page No. 91 |
| 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 maximum depth of the mining operation is 3.2m (2.2m abl + 1m bbl). The ground water table is at 12m below ground level. The mining operation will not intersect the Ground water table. |
| 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. | Not applicable. |
| 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. | Maximum site elevation within the project area is 43.35m to 48.07mm above Mean Sea level. It is proposed to excavate 3.2m average depth. |
| 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 with emphasis on local and native species and the species which are tolerant to pollution. | The plant species recommended for greenbelt development is shown in Chapter No.10, page No. 113 |
| 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. | The transportation will not have significant impact on the existing traffic density/ existing road. The transported vehicles are likely to move in the Major District Roads (MDR) and State Highways. The haulage road does not enrout any nearby villages. Vehicular Traffic Density Study details are discussed in Chapter No. 2, Page No. 33-34 |
| 33. | Details of the onsite shelter and facilities to be provided to the mine workers should be included in the EIA Report. | Onsite temporary shelter and facilities will be provided to the mine workers. The details are discussed in Chapter No.2, Page No. 35 |
| 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 lease area is lies on the river bed, depth of the mining average 3.2m (2.2m abl + 1m bbl). Mined out land will be got natural replenishment during the rainy seasons. |
| 35. | Occupational Health impacts of the Project should be anticipated and the proposed preventive measures spelt out in detail. Details of pre-placement medical | Impacts and mitigation measures on occupational health and safety are discussed in Chapter No. 4, Page No.99. |

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| | 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. | |
| 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. | No negative health impacts on public health are anticipated due this mining project. |
| 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. | Impacts and mitigation measures w.r.t Socio economic factors is detailed in Chapter No.4, Page No. 99. |
| 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. | A detailed Environmental Management Plan is prepared and discussed in Chapter No. 10, Page No. 110-118 |
| 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 (capital cost and recurring cost) is detailed in chapter No.2.0, Table No.2.15 Page No.35 |
| 42. | A Disaster management Plan shall be prepared and included in the EIA/EMP Report. | A Disaster Management Plan is prepared and discussed in Chapter No. 7, Page No. 105. |
| 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, Page No. 107 -108 |
| 44. | Besides the above, the below mentioned general points are also to be followed:- | |
| a. | Executive Summary of the EIA/EMP Report | Enclosed as separate volume |
| 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 as Annexure number – V |
| 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. | Questionnaire will be submitted with Final EIA/EMP report. |
| g. | While preparing the EIA report, the instructions for the | Instructions issued by MoEF & CC O.M. No. J- |

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| | 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. | 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 | Public hearing yet to be conducted. |
| 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 and Geological plan – Figure Number 2.8, Page No 26. |

1.6 POST ENVIRONMENT CLEARANCE MONITORING

The Proponent will carry out Compliance Monitoring Studies every six months once for Air, Water, Noise and other Environmental parameters as per the MoEF & CC and CPCB Guidelines & EC Conditions. As per the ToR Condition Ground water level and quality will be monitored once in 3 months. The half-yearly compliance status reports will be submitted in respect of stipulated Environmental Clearance terms and conditions to MoEF & CC Regional Office & SEIAA after grant of EC on 30th June and 31st December of each calendar year.

1.7 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. Brief descriptions of each Chapter are presented in Table No. 1.5.

Table 1.5: Structure of the EIA report

| S. No | Chapters | Title | Particulars |
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| 1 | Chapter 1 | Introduction | Presents an Introduction along with Scope and Objective of this EIA/EMP Study |
| 2 | Chapter 2 | Project Description | Presents the Technical Details of the Project |
| 3 | Chapter 3 | Description of Environment | Presents the Baseline Status for various Environmental Parameters in the Study Area for One Season (3 Months) |
| 4 | Chapter 4 | Anticipated Environmental Impacts and Mitigation Measures | Presents the Identification, Prediction and Evaluation of Environmental Impacts due to the Proposed Project Activities and presents Proposed Mitigation Measures |
| 5 | Chapter 5 | Analysis of Alternatives (Technology & Site) | Presents Analysis of alternatives with respect to site |
| 6 | Chapter 6 | Environment Monitoring Program | Present details of post project environment monitoring |
| 7 | Chapter 7 | Additional Studies | Presents Public Consultation, Risk Assessment and Disaster Management Plan |
| 8 | Chapter 8 | Project Benefits | Presents project benefits as: Improvements in the Physical Infrastructure, Social Infrastructure Employment Potential –Skilled; Semi-Skilled and Unskilled etc., |
| 9 | Chapter 9 | Cost Benefit Analysis | Environmental Cost Benefit Analysis has not been recommended at Scoping Stage – thus no analysis carried out separately in this EIA/EMP Report |
| 10 | Chapter 10 | Environmental Management Plan | Description of the administrative aspects to ensure the Mitigation Measures are implemented and their effectiveness monitored, after approval of the project |
| 11 | Chapter 11 | Summary & Conclusion | Summary of the EIA Report |
| 12 | Chapter 12 | Disclosure of Consultants Engaged | Disclosure of the Consultants |

Source: EIA Notification, 2006, Appendix – III

1.8 SCOPE OF THE STUDY

The main scope of the EIA study is to quantify the impact in the study area due to the proposed sand quarry and formulate the effective mitigation measures. 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 winter season (December 2022 to February 2023) for various environmental components so as to assess the anticipated impacts of the quarry project on the environment and suggest suitable mitigation measures for likely adverse impacts due to the proposed project.

Table 1.6: Environment attributes

| Sl.No. | Attributes | Parameters | Source and Frequency |
|--------|--|---|---|
| 1 | Ambient Air Quality | PM ₁₀ , PM _{2.5} , SO ₂ , NO ₂ | 24 hourly samples twice a week for three months at 8 locations |
| 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, Tiruchirapalli |
| 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) | At 8 locations data monitored once for 24 hours during EIA study |
| 6 | Soil Characteristics | Physical and Chemical Parameters | Once at 6 locations during study period |
| 7 | Land use | Existing land use for different categories | Based on Survey of India Toposheet 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 area and pattern, 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 Modeling done for the risk associated with mining |

Source: Onsite monitoring/ sampling

The data has been collected as per the requirement of the ToR issued by SEIAA – TN. The compliance of the ToR has been given in Table 1.4.

1.8.1 Regulatory Compliance & Applicable Laws/Regulations

- * Submitted application for Quarrying Lease as per Tamil Nadu Minor Mineral Concession Rules, 1959
- * Obtained Precise Area Communication Letter for Preparation of Mining Plan and obtaining Prior – Environmental Clearance as per Sub-Rule 13 of Rule 19 A, Tamil Nadu Minor Mineral Concession Rules, 1959
- * The Mining Plan has been approved under Rule 43 (8) of Tamil Nadu Minor Mineral Concession Rules, 1959
- * ToR Letter No. SEIAA-TN/F.No.9282/SEAC/ToR-1226/2022 Dated: 22.08.2022

CHAPTER – 2: PROJECT DESCRIPTION

2.0 GENERAL

This project is proposed to excavate 7,68,000m³ of Sand by Opencast Mechanized Mining Method without drilling and blasting. Sand will be transported by 10/20 Tonnes. The sand will be loaded directly to the trucks/lorries to nearby approved Government Sand Depot for Transportation to the needy customers, hence no mineral processing is involved.

The Trucks are loaded by excavators in direct supervision of the Assistant/ Junior Engineers Water Resources Department. The Competent Statutory Mines foreman will also be deployed for the Safety movement of vehicles inside the quarry. The sand is soft and fragile in nature and proposed to excavate 3.2m (2.2m abl + 1m bbl).

2.1 DESCRIPTION OF THE PROJECT

The proposed project is site specific and there is no additional area required for this project. There is no effluent generation/discharge from the project. Sand is proposed to be excavated by opencast mechanized method without drilling and blasting.

2.2 LOCATION OF THE PROJECT

- * The area lies between the Latitude of 10°53'53.3283"N to 10°54'01.5626"N and Longitude of 78°58'1.6578"E to 78°59'01.4184"E and marked in the Survey of India, Toposheet No. 58- J/13.

Table 2.1: Salient Features around the project area

| | |
|-----------------|--|
| Nearest Roadway | Nearest National Highway (NH-81) Trichy – Chidambaram – 8.0km -North West The Nearest State Highway (SH-22) Trichy – Kumbakonam – 3.0km-South |
| Nearest Village | Virahalaur – 1.0km - North |
| Nearest Town | Lalgudi – 6.5km- North West |
| Nearest Railway | Pullambadi Railway station – 7.5km- North West |
| Nearest Airport | Trichy Airport – 32 km – Southwest |
| Seaport | Tuticorin – 255 Km-Southwest |

Source: Survey of India Toposheet

Table 2.2: Boundary Co-Ordinates

| Boundary Pillar No. | Latitude | Longitude |
|---------------------|-------------------|-------------------|
| 1 | 10° 53' 59.8297"N | 78° 58' 21.6578"E |
| 2 | 10° 54' 01.5626"N | 78° 59' 01.1264"E |
| 3 | 10° 53' 55.0612"N | 78° 59' 01.4184"E |
| 4 | 10° 53' 53.3283"N | 78° 58' 21.9501"E |

Figure 2.1: Digitized location map covering 10 km radius

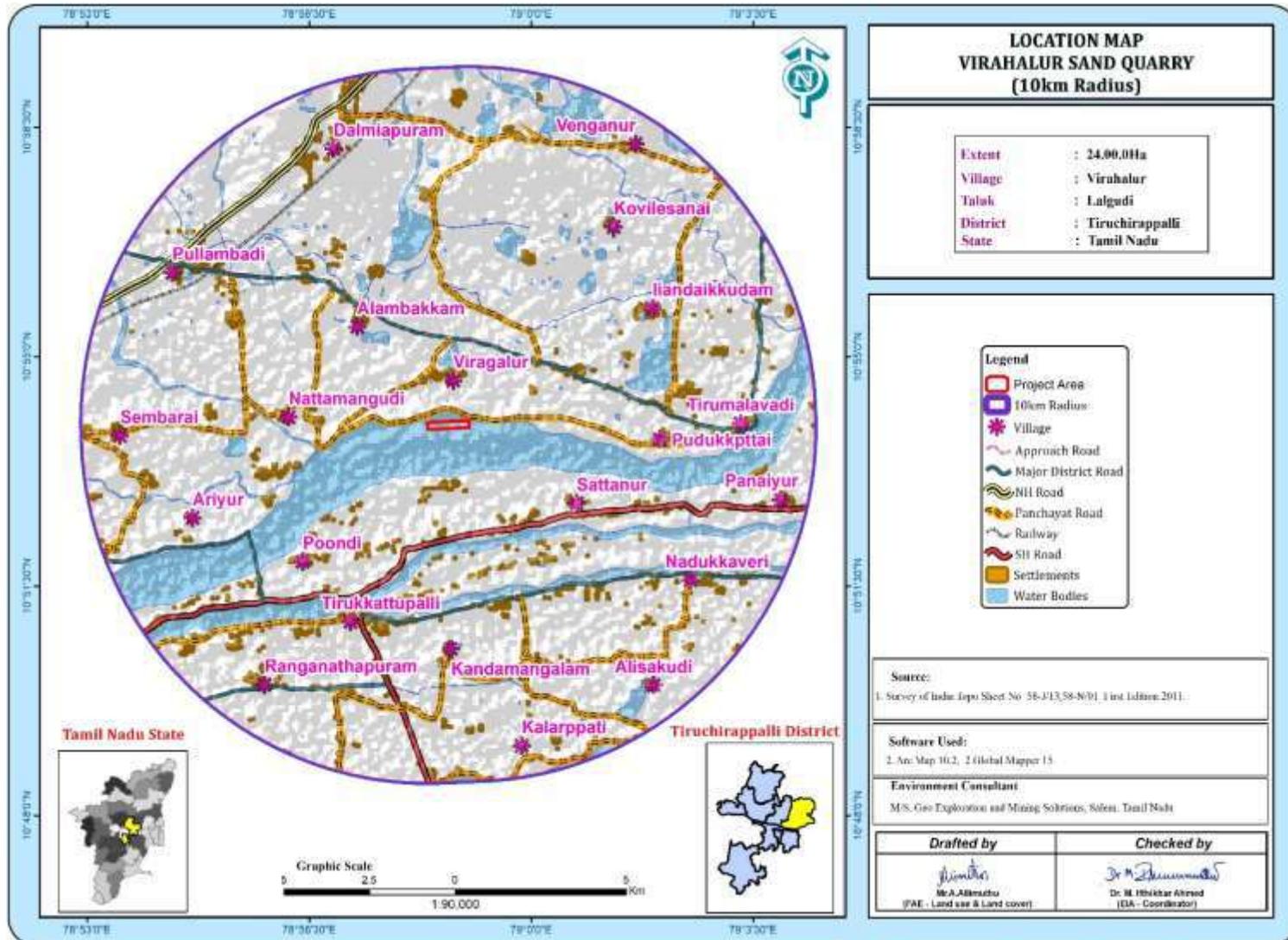


Figure 2.2: Digitized location map covering 5 km radius

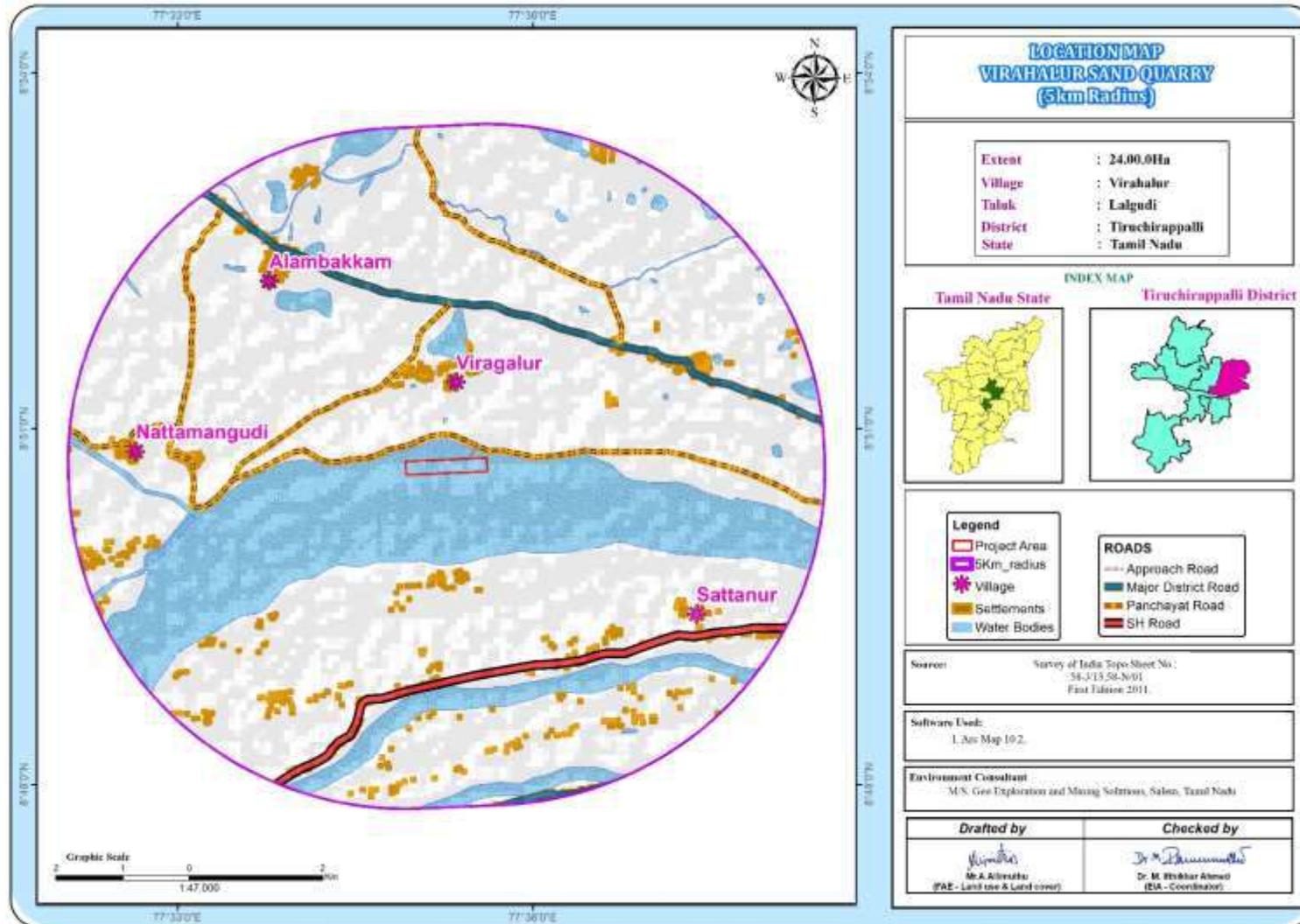


Figure 2.3: Location map on the geo referenced Toposheet (2km radius)

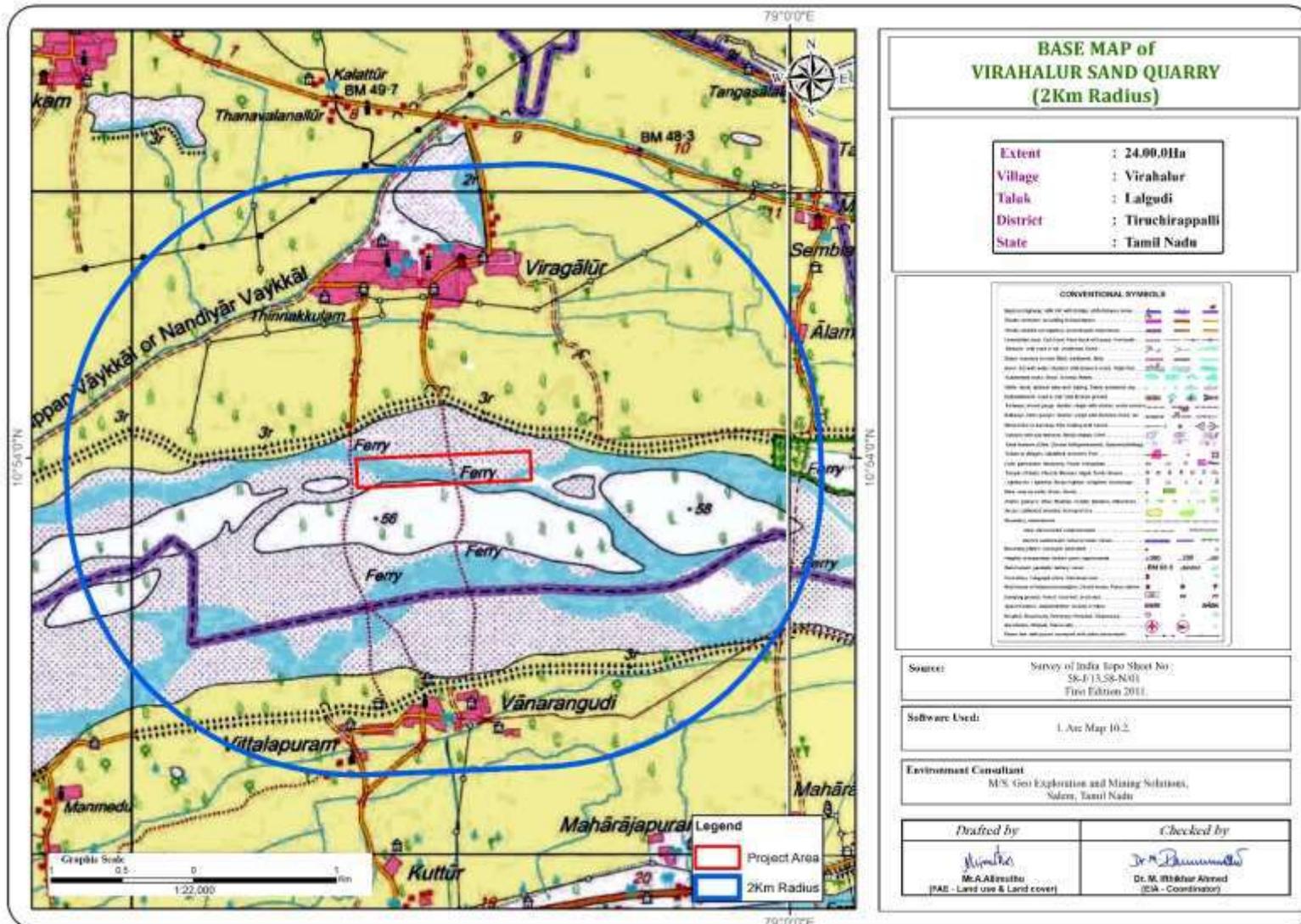


Figure 2.4: Digitized location map covering 1km radius

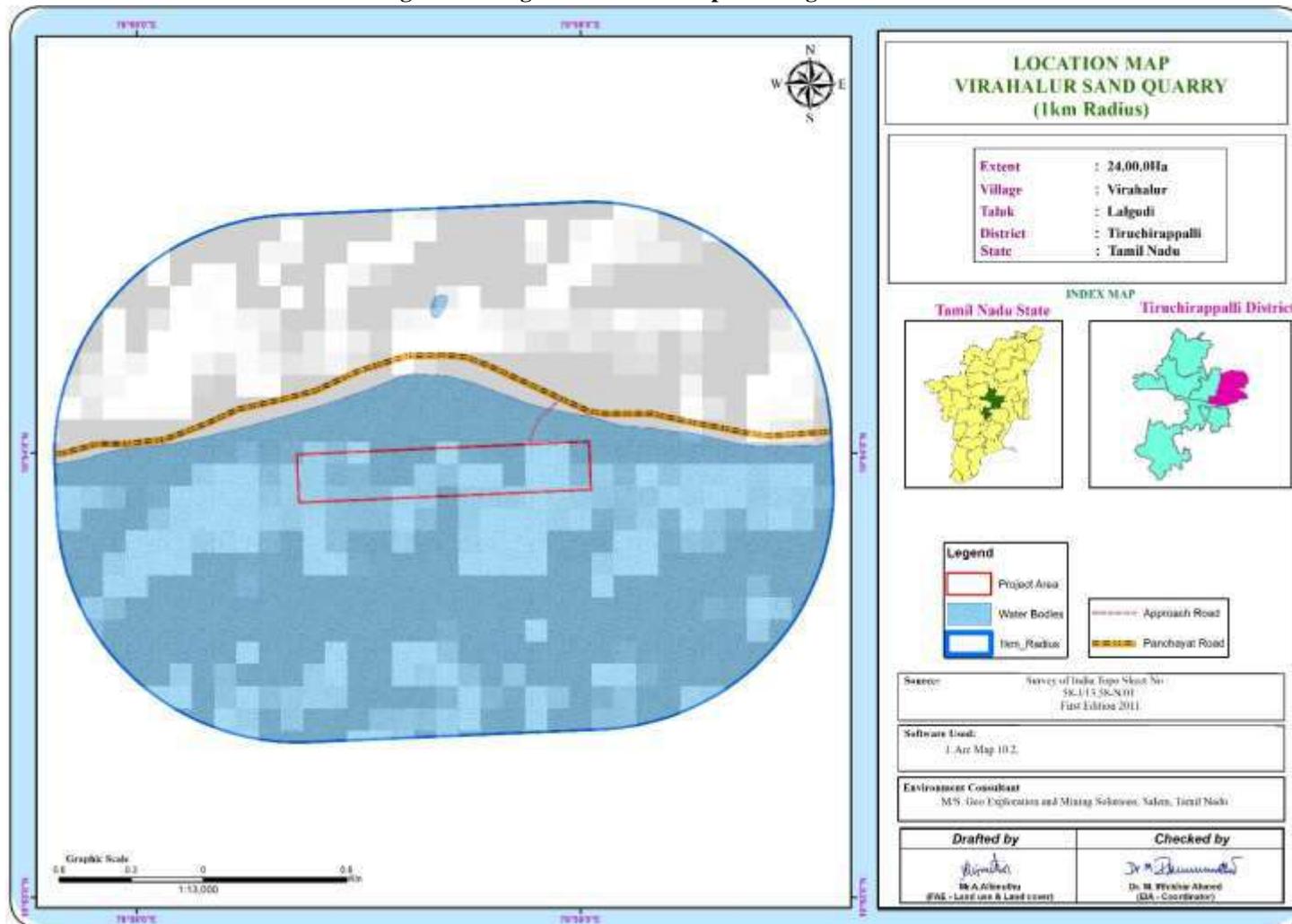
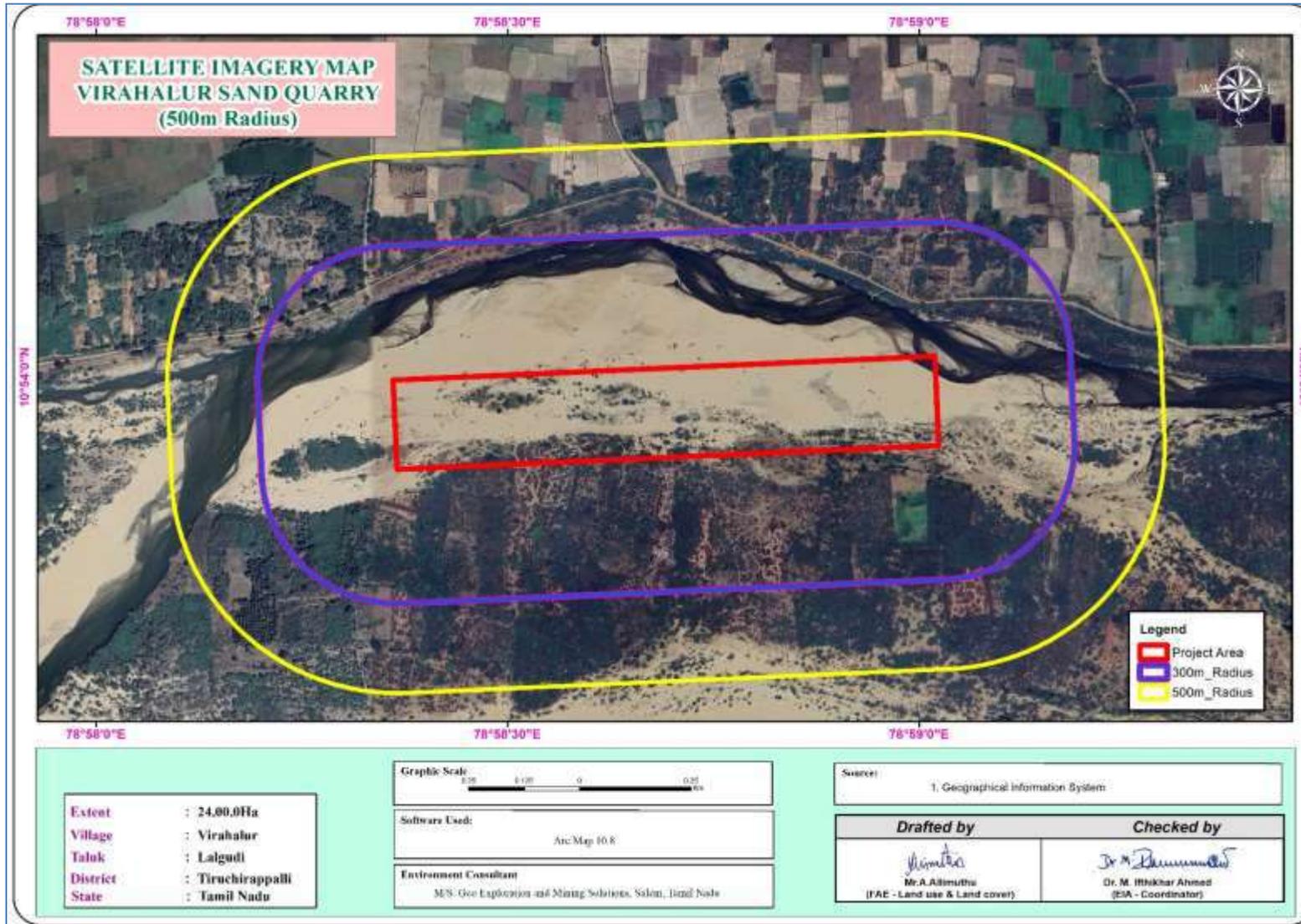


Figure 2.5: Quarry Boundary superimposed on Satellite Imagery



Figure 2.6: Google Earth Image showing 300 and 500m radius from Project area



2.2.1 Project Area

- * The Sand quarry is proposed to operate by opencast mechanized method of mining and the project is site specific
- * There is No beneficiation or processing proposed inside the project area.
- * The river bed level is 43.69 on the upstream side and 43.45m on the downstream side
- * It is a Government land maintained by Water Resources Department, Tiruchirappalli District.

Figure 2.7: Topographical view of the project area**2.2.2 Land Use Pattern of the Core Zone**

The project area falls in the Coleroon River, topography of the area exhibits plain topography with gentle ups and downs, sloping towards the East side. The altitude of the area is varying from 43.35m to 48.07m above MSL and the river bed level is 43.69 on the upstream side and 43.45m on the downstream side.

Figure 2.8: Topography, Geological and Environment Management Plan

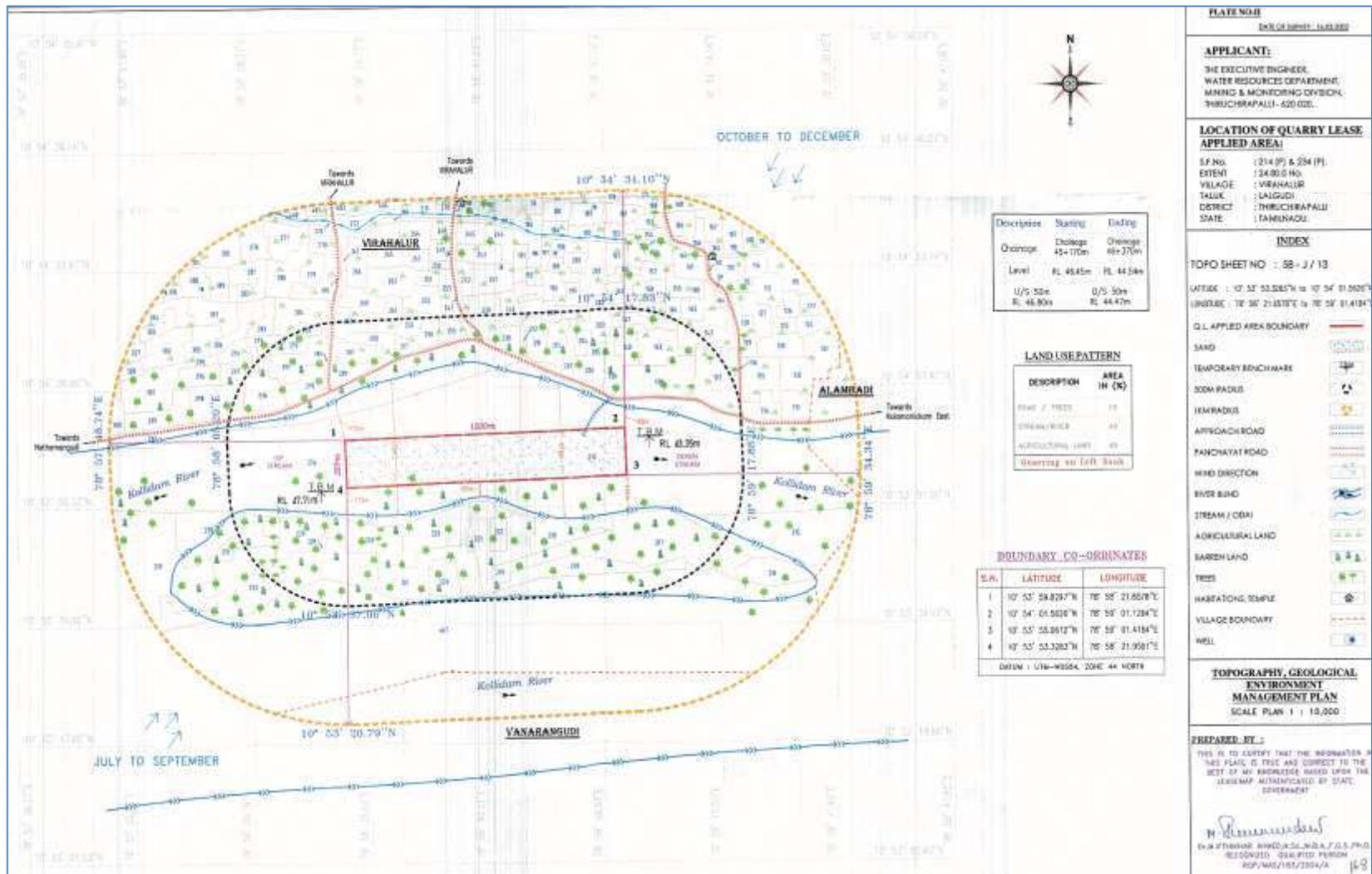


Figure 2.9: Surface, Geological and Yearwise development Plan and Sections

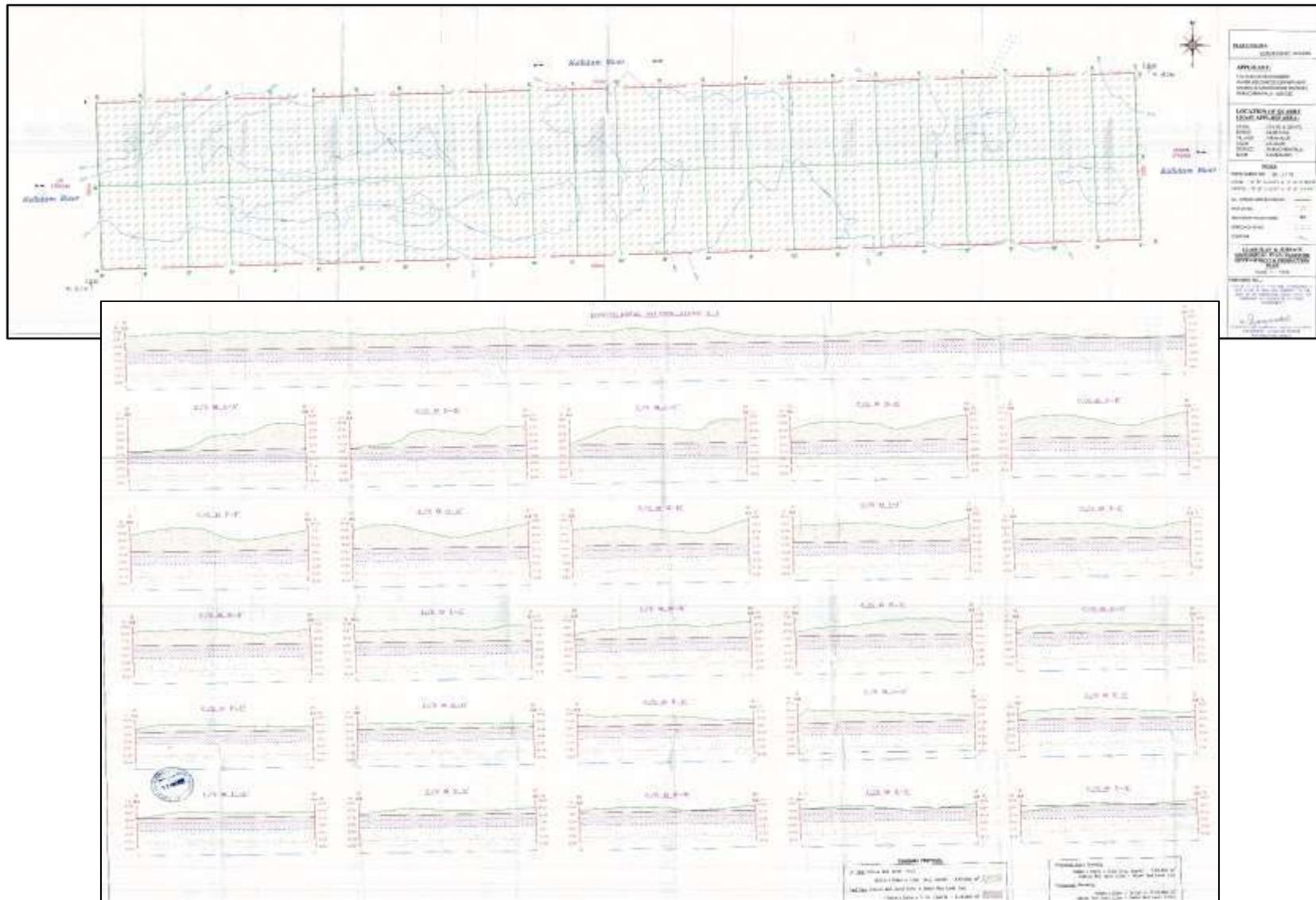


Table 2.3: External infrastructures

| S. No | Particulars | Location | Direction | Approximate Distance in Km |
|-------|-------------------------|-----------------|-----------|----------------------------|
| 1 | Nearest Post Office | Virahalur | North | 1km |
| 2 | Nearest School | Virahalur | North | 1km |
| 3 | Nearest Dispensary | Pullambadi | NW | 8km |
| 4 | Nearest Town | Lalgudi | SW | 17km |
| 5 | Nearest Police Station | Lalgudi | SW | 17km |
| 6 | Nearest Hospital | Pullambadi | NW | 8km |
| 7 | Nearest D.S.P. Office | Lalgudi | SW | 17km |
| 8 | Nearest Railway Station | Pullambadi | NW | 8km |
| 9 | Nearest Airport | Tiruchirappalli | SW | 32km |
| 10 | Nearest Harbour | Thoothukudi | SW | 253km |
| 11 | District Head Quarters | Tiruchirappalli | SW | 32km |

2.2.3 Size or Magnitude of Operation

Table 2.4: Mining details

| Particulars | Details |
|--------------------------------------|--|
| Method of Mining | Opencast mechanized |
| Geological resources | 12,00,000m ³ |
| Mineable reserves | 7,68,000m ³ |
| Production for two years plan period | 3,60,000m ³ for first year 4,08,000m ³ for 2 nd year |
| Depth of Mining | 3.2m (2.2m abl + 1m bbl) |
| Water table | 12 bgl |

Source: Approved mining plan

2.3 GEOLOGY

2.3.1 Regional Geology

The entire area is covered by Sand, the Cauvery river is generated at Tala Kaveri, Kodagu District, Karnataka State and the river is encountered in Tamil Nadu via Hogenakkal, Dharmapuri District and Cauvery River passess through Salem, Erode, Namakkal, Karur, Thiruchirappalli, Thanjavur and Mayiladuthurai Districts. The Main Catchment area of Cauvery River is Sathyamangalam Hill Ranges, ooty and Palani hill ranges in Tamil Nadu State and the area consists mainly Gneissic rocks, Charnockites, Migmatites etc., The Kollidam River splits from the main branch of the Cauvery River at the island of Srirangam and flows eastward Direction for diversion of water during heavy rain and flood in the Cauvery River also for irrigation purpose and confluence with Bay of Bengal.

The Coleroon River is more widen in Virahalur area, hence the areas contain more siltation and the rate of sedimentation is quite high which leads to the reduction in carrying capacity resulting in a loss of functional efficiency/ carrying capacity of the river.

Figure 2.10: Geology map of the area

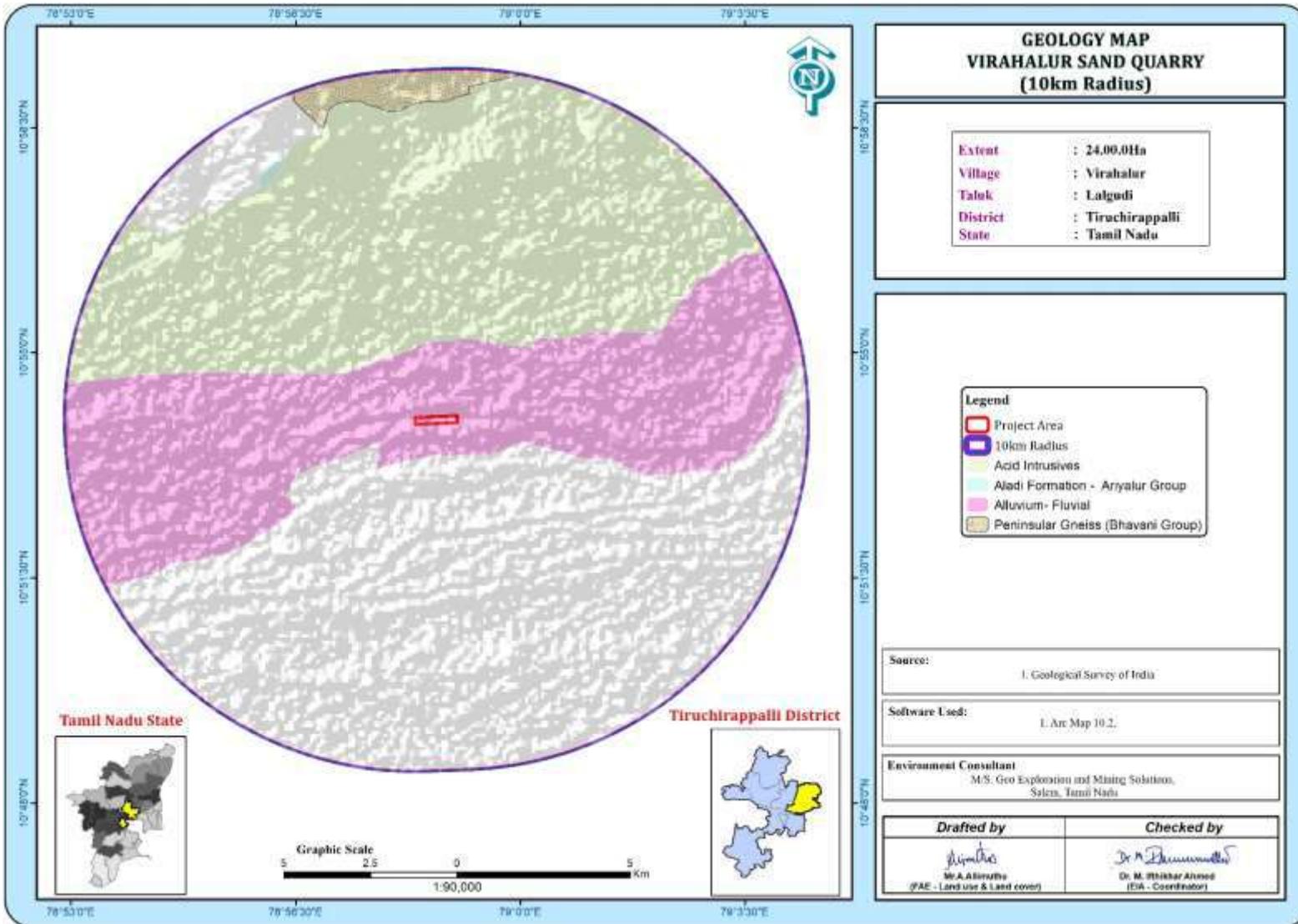
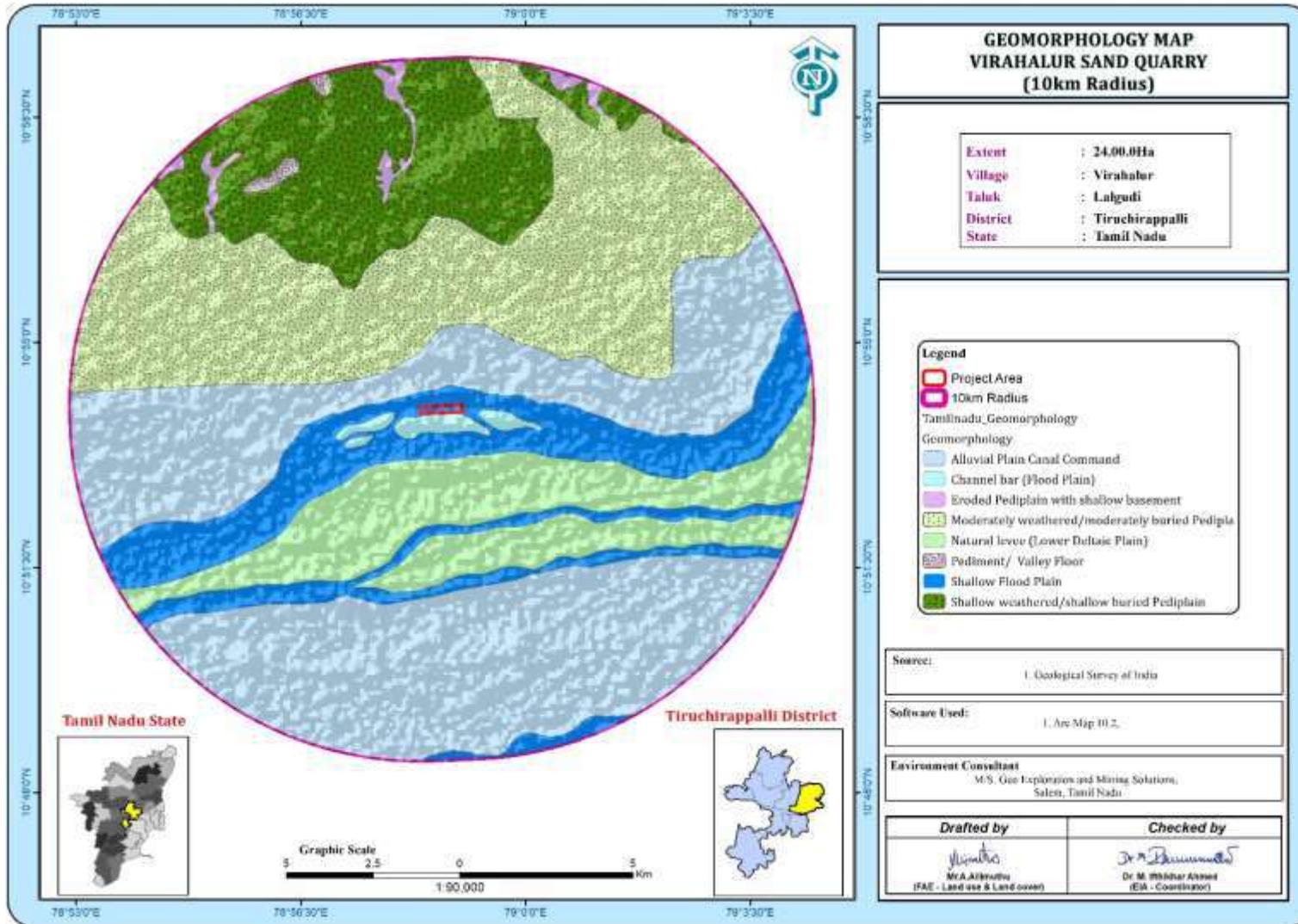


Figure 2.11: Geomorphology map of the area



2.3.2 Site Specific Geology

The area is fully covered by Sand Deposit, the altitude of the area varies from 43.35m to 48.07m above MSL and the river bed level is 43.69 on the upstream side and 43.45m on downstream side.

2.4 QUALITY OF RESERVE

The entire area is covered by sand. The sand is derived by erosion and transportation of rock.

2.5 RESERVE ESTIMATION AND PRODUCTION

The Sand deposit in the area recommended for quarrying lease is simple flat-bedded deposit of shallow depth. The geological resources of Sand in the area are estimated by Cross sectional method, The Geological plan and Sections for every 50m interval with 10m interval of spot level is prepared based on the Topographical plan.

The Geological plan demarcating the commercially viable sand has been prepared in 1:1,000 Scale. The quantity of the Sand to be desilted is calculated by length and width of the lease area, which is suitably chosen to cover the maximum area.

The total quantity of production for the two years has been estimated as 7,68,000 m³ of Sand for a total depth of 3.2m (2.2m abl + 1m bbl).

Table 2.5: Resources and Reserves

| Description | Sand Quantity in m ³ |
|--------------------------|---------------------------------|
| Geological Resources | 12,00,000 |
| Mineable Reserves | 7,68,000 |
| Yearwise Production | 7,68,000 |
| Peak Production Proposed | 4,08,000 (2 nd year) |
| Peak Production per Day | 1,632 |

Source: Approved Mining Plan

Table 2.6: Year wise Production details

| Year | Sand (m ³) |
|--------------|------------------------|
| 1 | 3,60,000 |
| 2 | 4,08,000 |
| Total | 7,68,000 |

Source: Approved Mining Plan

| | | |
|----------------------------------|---|-------------------------|
| One lorry load | = | 6m ³ |
| No.of working days | = | 250 days |
| Sand | | |
| Total sand for the 2 years | = | 7,68,000m ³ |
| Total lorry loads per day | = | 7,68,000/6 |
| | = | 1,28,000 Lorry loads |
| | = | 1,28,000 /2 years |
| | = | 64,000/250 days |
| | = | 256 Lorry loads per day |
| Total Lorry loads per day | = | 256 loads |

2.5.1 Disposal of overburden / Waste

There is no over burden / waste within the applied area. The quarried out sand will be directly loads into tippers to the Government stock yard unit.



2.6 METHOD OF MINING

Opencast method of shallow mining is proposed. Initially to approach the proposed site a temporary road will be formed by using of Gravel mixed with bio-degradable materials and formed a grit around the sand desilting site to move the vehicles easily. During forming the approach road and grit, necessary temporary pipes will be provided wherever necessary for free flow of water to downstream. After forming this approach roads, the trucks/ lorries are allowed for transportation after paying the necessary fees to the Government bodies. In this process contract labours from neighboring villages are engaged for the purpose of maintaining the approaches. Regulating the vehicle movements, assisting to take levels, issuing of permits etc., to regulate the desilting operation in a scientific and systematic manner. The sand will be loaded directly to the trucks / Lorries for transportation to the needy customers and the Silt will be directly loaded to the trucks / Lorries for transportation to the nearby Farmers for Agriculture purpose with free of cost. Hence, no mineral processing is involved.

The trucks are loaded by excavators in direct supervision of the Assistant / Junior Engineers Public Works Department. The competent statutory mines foreman will also be deployed for the safety movement of vehicles inside the quarry.

After that the loaded vehicles are allowed to go out only after covering the sand and silt load properly by tarpaulin to avoid any spillage.

Table 2.7: Lists of Machineries Proposed

| Sl.No. | Machinery | Numbers of Units | Capacity | Make | Motive Power |
|--------|--------------------------------|------------------|--------------------|--------------|--------------|
| 1 | Excavator attached with bucket | 4 | 0.90m ³ | TATA Hitachi | Diesel Drive |
| 2 | Tipper | 15 | 10/20 tons | Tata | Diesel Power |

Source: Approved Mining plan

The total direct manpower requirement for the full scale quarrying operations is given below.

Table 2.8: Man power requirement

| <i>1. Supervisory and Skilled Persons</i> | | | |
|---|-------------------------|----------------------|---|
| <i>S.No.</i> | <i>Designation</i> | <i>No. of Person</i> | |
| 1 | WRD Assistant Engineer | 1 | |
| 2 | Technical Assistant | 1 | |
| 3 | Excavator Operator | 4 | |
| 4 | Permit Slip issuer | 3 | |
| 5 | Office Helper | 2 | |
| Total | | 11 | |
| <i>2. Unskilled</i> | | | |
| 6 | Excavator Co – operator | 4 | |
| 7 | Traffic Regulator | Entrance | 2 |
| | | Exit | 2 |
| | | Quarrying Site | 3 |
| 8 | Bucket Watcher /Stopper | 4 | |
| 9 | Track Maintainer | 8 | |
| 10 | Watchman (Three Shift) | 6 | |
| Total | | 29 | |
| Grand Total | | 40 | |

Source: Approved Mining plan

2.6.1 Conceptual Mining Plan/ Final Mine Closure Plan

The sand deposit is soft & fragile in nature and occurring as a layer of around 5 thickness it is proposed to excavate 3.2m (2.2m abl + 1m bbl). After the completion of quarrying operation the land will be got natural replenishment in the upcoming rainy seasons.

2.6.2 Traffic Density:

Traffic density measurements were performed at two locations at one location is Pullambadi - Poondi village road which is about 5.0km in the Southwest and another location is Pullambadi – Thirumazhapadi Road which is about 2.0Km in the North side as per IRC – 86 – 1983 Guidelines. 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.

Figure.2.12: Mineral Transportation route map



The traffic volume survey was done at two locations as given in the table 2.12. The location for the survey was identified in accordance with mineral transportation route from the mines.

The monitoring was performed on 12.12.2022. Traffic density measurement were made continuously for 24 hours by visual observation and counting of vehicles under three categories, viz., Heavy motor vehicles (HMV), Light Motor Vehicles (LMV) and two/three wheelers. Two skilled persons were involved in the traffic survey, 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.

Table.2.9: Traffic Survey Locations

| Station code | Station location | Distance and Direction | Type of Road |
|--------------|-----------------------------|------------------------|----------------------------|
| TS1 | Pullambadi - Poondi | 5.0km – Southwest | Village road (Single lane) |
| TS2 | Pullambadi – Thirumazhapadi | 2.0km – North | MDR (Two lane) |

Source: On-site monitoring by GEMS FAE & TM

Table 2.10: Existing Traffic Volume

| Station code | HMV | | LMV | | 2/3 Wheelers | | Total PCU |
|--------------|-----|-----|-----|-----|--------------|-----|-----------|
| | No | PCU | No | PCU | No | PCU | |
| TS1 | 90 | 270 | 48 | 48 | 198 | 99 | 417 |
| TS2 | 122 | 366 | 62 | 62 | 230 | 115 | 543 |

Source: On-site monitoring by GEMS FAE & TM

- PCU conversion factor for HMV (Trucks and Bus) = 3, LMV (Car, Jeep and Auto) = 1 and 0.5 for Motor Vehicles (2/3 Wheelers)

Table 2.11: Sand Hourly Transportation Requirement

| Transportation of Sand per day | | |
|--------------------------------|------------------|---------------|
| Capacity of trucks | No Trips per day | Volume in PCU |
| 20 tonnes | 256 | 85 |

Source: Data analyzed from Approved Mining plan

Table 2.12: Summary of Traffic Volume

| Route | Capacity of the traffic in PCU | Incremental traffic from the mine in PCU | Total traffic volume | Hourly Capacity in PCU as per IRC – 1960 guidelines |
|-----------------------------|--------------------------------|--|----------------------|---|
| Pullambadi - Poondi | 417 | 85 | 502 | 1200 |
| Pullambadi – Thirumazhapadi | 543 | 85 | 628 | 1200 |

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

Due to this project the existing traffic volume will not exceed

As per the IRC 1960 this existing 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.

2.6.3 Mineral Beneficiation and Processing

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

2.7 PROJECT REQUIREMENT

2.7.1 Water Source & Requirement

Detail of water requirements in KLD as given below:

Water will be purchased from water vendors by water tankers. Packaged Drinking Water is available from the nearby approved water vendors.

Table 2.13: Water Requirements

| Purpose | Quantity | Sources |
|------------------|----------------|---|
| Domestic purpose | 1.0 KLD | Drinking water is available from the nearby community wells |
| Dust suppression | 1.0 KLD | From existing bore well on nearby mine |
| Green belt | 1.0 KLD | From existing bore well on nearby mine |
| Total | 3.0 KLD | |

* Drinking water will be sourced from approved water vendors

Source: Approved Mining Plan & Pre – Feasibility Report

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).

The temporary infrastructures such as Mine Office, First Aid Room, Rest Shelter etc., will be constructed outside the lease hold area after the Lease deed execution. No workshops are proposed inside the area hence there will not be any process effluent generation from the proposed project area. 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.

2.7.3 Fuel Requirement

Fuels are used for operating machineries and vehicles during desilting process. Fuels required for excavator for the entire project life is **1,28,000 liters** of HSD (High Speed Diesel).

2.8 PROJECT IMPLEMENTATION SCHEDULE

The Sand quarry operation will commence after the grant of Environmental Clearance, CTO from the 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 for the project

| Sl. No. | Particulars | Time Schedule (In Month)* | | | | | Remark if any |
|---------|-------------------------|---------------------------|-----------------|-----------------|-----------------|-----------------|-------------------------|
| | | 1 st | 2 nd | 3 rd | 4 th | 5 th | |
| 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

Table 2.15 Project cost

| Sl.No | Description | Cost in Rupees |
|-------------------|--------------|-------------------------|
| 1 | Project cost | Rs.1,34,10,000/- |
| 2 | EMP | Rs. 1,50,000/- |
| Total cost | | Rs.1,35,60,000/- |

Source: Approved Mining Plan

CSR/CER –

It is a public and Government bonafied project hence, cost for Corporate Environment Responsibilities (CER) does not involved in this project. If any direction given by the competent authority for CER activity, the same will be followed by WRD department after obtained permission from the Government.

CHAPTER – 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.

As per the MoEF & CC Office Memorandum F. No IA3-22/10/2022.IA.III (E 177258) Dated 8th June, 2022 the baseline data is utilized for this proposal.

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 December 2022 – February 2023 with CPCB guidelines. Environmental data has been collected with reference to cluster quarries by EHS 360 LABS PRIVATE LIMITED (Approved by ISO/IEC 17025:2017), 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 project is considered for EIA study. The data collection has been used to understand the existing environment scenario around the project site 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 project site and buffer zone taken as 10km radius from the periphery of the project site. Both Core zone and Buffer zone is taken as the study area.

Study Period

The baseline study was conducted during the winter season i.e. December 2022 – February 2023 (3 Months).

Study Methodology

Standard methodologies have been followed in developing the baseline report. The methodology adopted for the study is outlined below:

- * Conducting reconnaissance surveys for understanding the study area; and
- * Selecting sampling locations for conducting various environment baseline studies.

The sampling locations have been selected based on the following:

- * Predominant wind directions recorded at project site and comparison with secondary source recorded by the Indian Meteorological Department (IMD) observatory nearest to the site;
- * Existing topography;
- * Drainage pattern and location of existing surface water bodies like lakes/ponds, rivers and streams;
- * Locations of villages / towns / sensitive areas; and

- * Areas, which represent baseline conditions

The field observations have been used to:

- * Assess the positive and negative impacts due to the proposed project;
- * Suggest appropriate mitigation measures for remediating the adverse environmental impacts, if any; and
- * Suggesting post-project monitoring requirements and suitable mechanism for it

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

Table 3.1: Environmental monitoring attributes and frequency of monitoring

| Attribute | Parameters | Frequency of monitoring | No. of locations | Protocol |
|------------------------|---|---|---|---|
| Land-use | 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 Characteristics | Physio-Chemical Characteristics | Once during the study period | 6 (1 core & 5 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 CO | 24 hourly twice a week (December 2022 to February 2023) | 8 (1 core & 7 buffer) | IS 5182 Part 1-23 National Ambient Air Quality Standards, CPCB |
| Noise Levels | Ambient Noise | Hourly observation for 24 Hours per location | 8 (1 core & 7 buffer) | 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 EHS 360 Labs Private Limited Laboratories in association with GEMS

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

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 cluster 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

Indian Remote Sensing satellite IRS-P6, LISS III of Bhuvan (ISRO), multi-spectral digital data has been used for the preparation of land use/ land cover map of present study.

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.

An image interpretation keys were developed based on such image characteristics, which enable interpretation of satellite images for land use/land cover features. Further, the land use / land cover and other baseline layers was put in GIS database for integration, analysis, statistics generation and final out in the form of land use land cover map.

Interpreted thematic details were transferred on the base map. Besides, other supporting data like project reports and statistical data published by various Government departments have also been used.

Table 3.2: Major land use/land cover of the study area

| S.No | Classification | Area_Ha | Area_% |
|-----------------------------|-------------------------|-----------------|---------------|
| Builtup | | | |
| 1 | Builtup Urban | 152.65 | 0.46 |
| 2 | Builtup Rural | 1518.67 | 4.54 |
| 3 | Builtup Mining | 517.87 | 1.55 |
| Agricultural Land | | | |
| 4 | Crop Land | 22105.19 | 66.14 |
| 5 | Agricultural Plantation | 1246.03 | 3.73 |
| 6 | Fallow Land | 3034.68 | 9.08 |
| Forest | | | |
| 7 | Scrub Forest | 33.01 | 0.10 |
| Barren/Wasteland | | | |
| 8 | Scrub Land | 195.76 | 0.59 |
| 9 | Sandy Area | 22.98 | 0.07 |
| 10 | Barren Rocky | 167.64 | 0.50 |
| Wetlands/Waterbodies | | | |
| 11 | Waterbodies | 4429.02 | 13.25 |
| Total | | 33423.49 | 100.00 |

Figure 3.1: Physiography Map of the study area

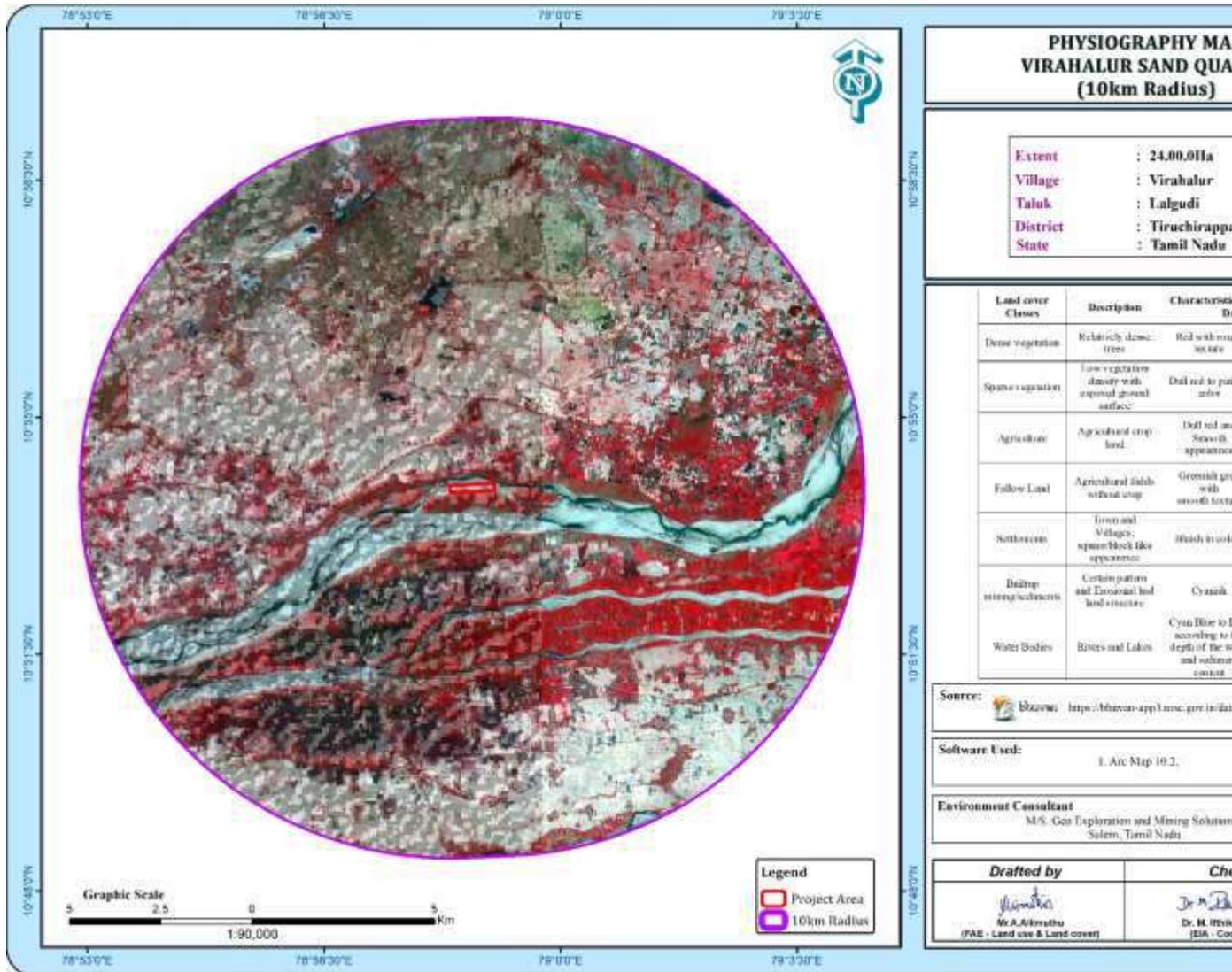


Figure 3.2: Land use – Land cover map of the study area

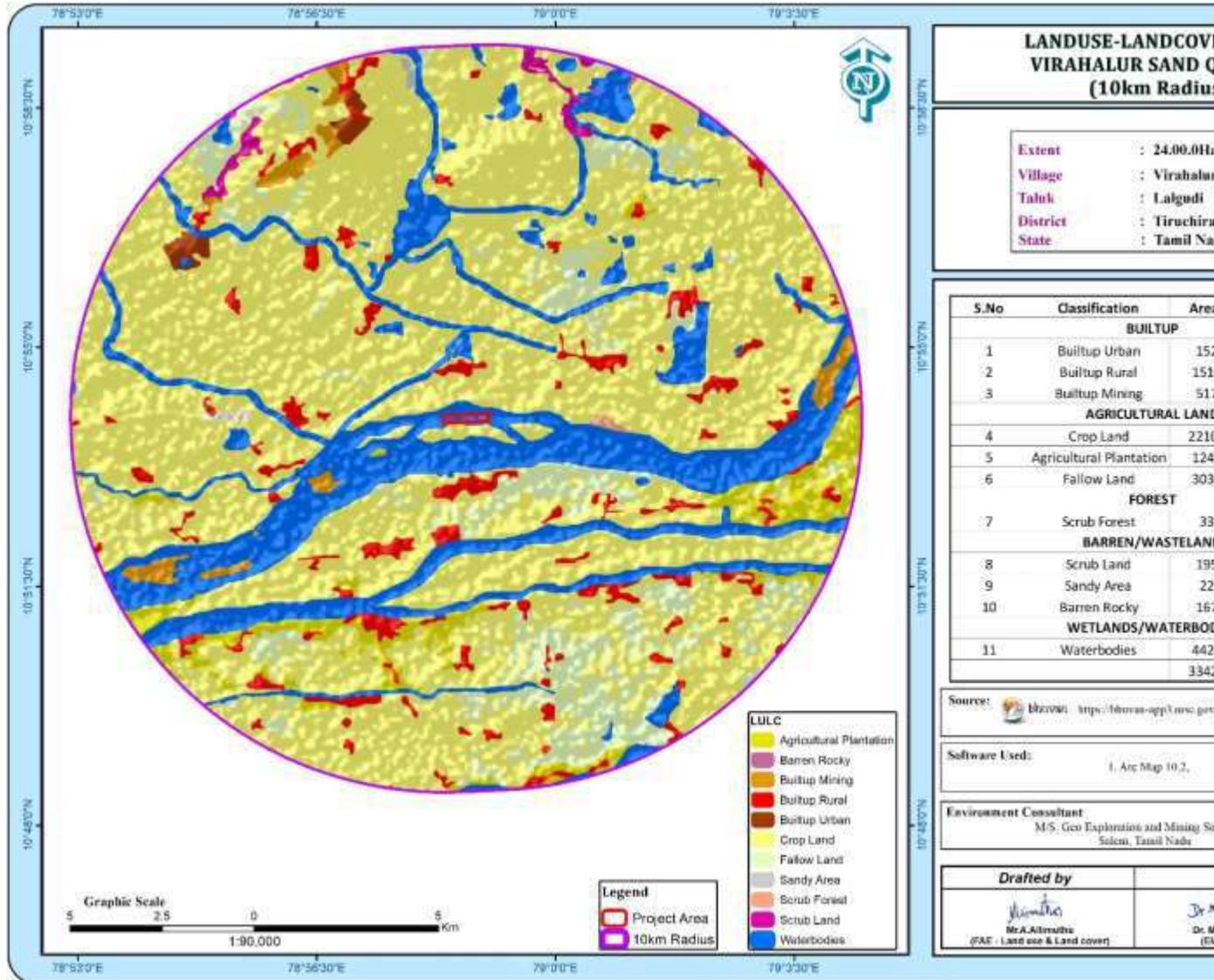
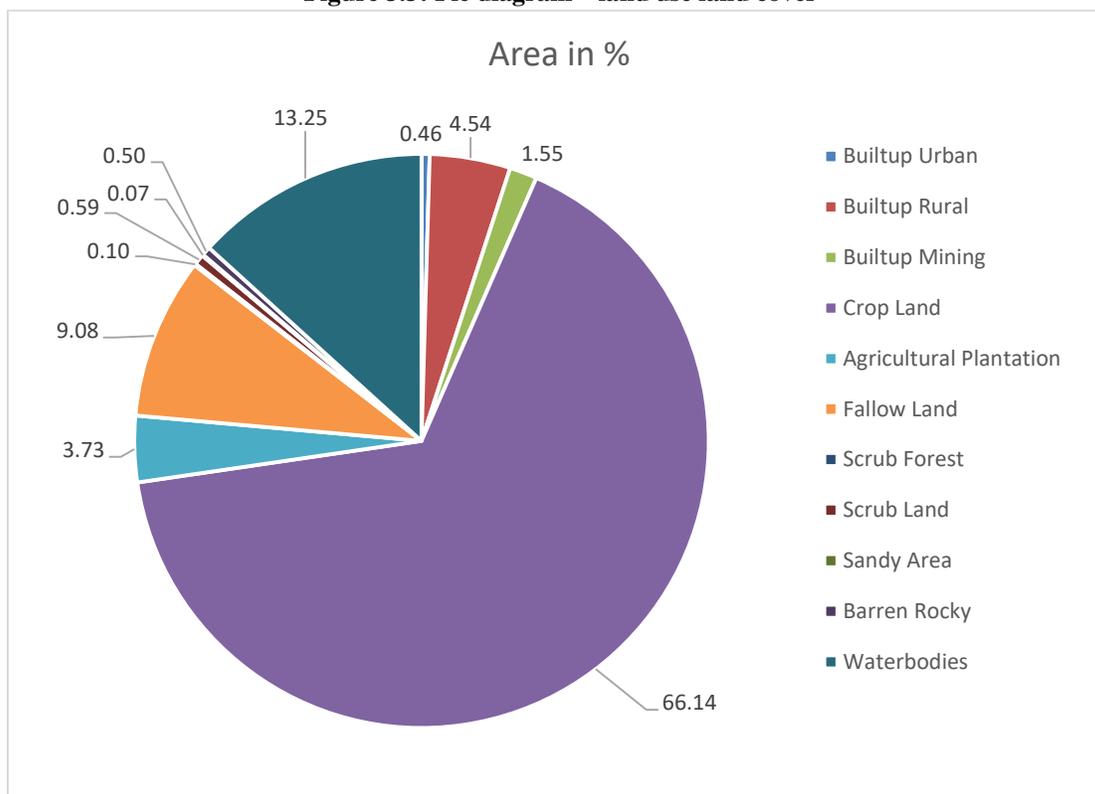


Figure 3.3: Pie diagram – land use land cover

Source: Bhuvan Land use/ Land Cover Data

Interpretation:

- Built-up area = 1671.32ha ie., 5.00 %
- Agriculture land = 26385.90 ha ie., 78.94 %
- Barren land = 386. ha ie., 1.16 %
- Mining area = 517.87ha ie., 1.55 %

Total Mining area in the study area is 517.87 Ha ie.,1.55%. This proposed project area occupies 4.63 % overall area. This small percentage of Mining Activities shall not have any significant impact on the environment.

3.1.2 Topography

The lease applied area exhibits flat topography with ups and downs of sand shoals, having gentle slope towards east side. The altitude of the area varies from 43.35m to 48.07m above MSL and the river bed level is 43.69 on the upstream side and 43.45m on downstream side above from MSL.

3.1.3 Drainage Pattern of the Area

The project located at Coleroon River, 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 W to E 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 Environmental Features in the Study Area

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

Table 3.3: Environmental Settings in the study area

| S.No | Sensitive Ecological features | Name | Arial Distance in km from project boundary |
|------|--------------------------------------|------------------------------|--|
| 1 | National Park/ Wild life sanctuaries | Karaivetti Birds Sanctuary | 9.7 Km – Northeast |
| 2 | Reserve forest | Kulamanikam R.F | 2.5 Km- East |
| 3 | Tiger Reserve/Elephant Reserve | Sathyamangalam Tiger Reserve | 182 km – North West side |
| 4 | Core Zone of Biosphere Reserve | None | Nil within 10 km Radius |
| 5 | Migratory birds | None | Nil within 10 km Radius |
| 6 | Mangroves | Pitchavaram Mangroves | 105km - Northeast |
| 7 | Mountains/Hills | None | Nil within 10 km Radius |
| 8 | Notified Archaeological sites | None | Nil within 10 km Radius |
| 10 | Defense Installation | None | Nil within 10 km Radius |

Source: Survey of India Toposheet, Village Cadastral Map& Google Earth/Maps

Table 3.4: List of Water bodies near the project site

| S.Nos | Label | Distance & Direction |
|-------|-------------------|----------------------|
| 1 | Elandai Lake | 5Km_NE |
| 2 | Viragalur Lake | 1.5Kn_N |
| 3 | Odai | 3Km_E |
| 4 | Cauvery River | 3Km_S |
| 5 | Kodamurtti River | 3Km_SE |
| 6 | Vennar River | 4.5Km_SE |
| 7 | Palaganatham Lake | 4.5Km_N |
| 8 | Andi Odai | 8Km_NE |

Table 3.4A: List of Water bodies near the project site

| No | Name | Distance & Direction |
|----|------------------------------|----------------------|
| 1 | Dalmia Cement Factory | 8Km_NW |
| 2 | Shri Menakshi cement Factory | 9.5Km_NW |
| 3 | Thiru Hirudaiya cotton mill | 9Km_NW |

3.1.5 Seismic Sensitivity

Zone II, low damage risk zone as per BMTPC, Vulnerability Atlas of Seismic zone of India IS: 1893 – 2002. No history of such incidents in the area. The project area falls in the sedimentary terrain on the peninsular shield of south India which is highly stable.

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 analyzed for different parameters. The locations of the monitoring sites are detailed in Table 3.4 and Figure 3.3.

Table 3.5 – Soil Sampling Locations

| S. No | Location Code | Monitoring Locations | Distance & Direction | Coordinates |
|-------|---------------|----------------------|----------------------|-----------------------------|
| 1 | S-1 | Near Project Area | 370m North | 10°54'11.39"N 78°58'19.18"E |
| 2 | S-2 | Kandiratheertham | 6km East | 10°54'22.36"N 79° 2'16.81"E |
| 3 | S-3 | T.Kallikudi | 6.3km West | 10°54'7.02"N 78°54'49.16"E |
| 4 | S-4 | Thirukattupalli | 5.8km SW | 10°50'59.62"N 78°57'0.76"E |
| 5 | S-5 | Konerirajapuram | 4.0km SE | 10°52'4.50"N 79° 0'8.51"E |
| 6 | S-6 | Pudurpalayam | 5.5km NW | 10°56'35.32"N 78°56'46.87"E |

Source: On-site monitoring/sampling by EHS 360 Labs Private Limited Laboratories in association with GEMS

The objective of the soil sampling is -

1. To determine the baseline soil characteristics of the study area;
2. To determine the impact of proposed activity on soil characteristics and;

To determine the impact on soil more importantly agriculture production point of view.

Methodology –

For studying soil quality, sampling locations were selected to assess the existing soil conditions in and around the proposed project site representing various land use conditions. The samples were collected by auger boring into the soil up to 90-cm depth. Six (6) 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 sealed 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 analyzed at the laboratory. |

Source: On-site monitoring/sampling by EHS 360 Labs Private Limited in association with GEMS

Soil Testing Result –

The samples were analyzed 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 analyzed for soil are bulk density, porosity, infiltration rate, pH and Organic matter, kjeldahi Nitrogen, Phosphorous and Potassium. The standard classification of soil and physico-chemical characteristics of the soils are presented below in Table 3.6 & Test Results in Table 3.7.

Figure 3.4: Soil Sampling Locations around 10 km radius

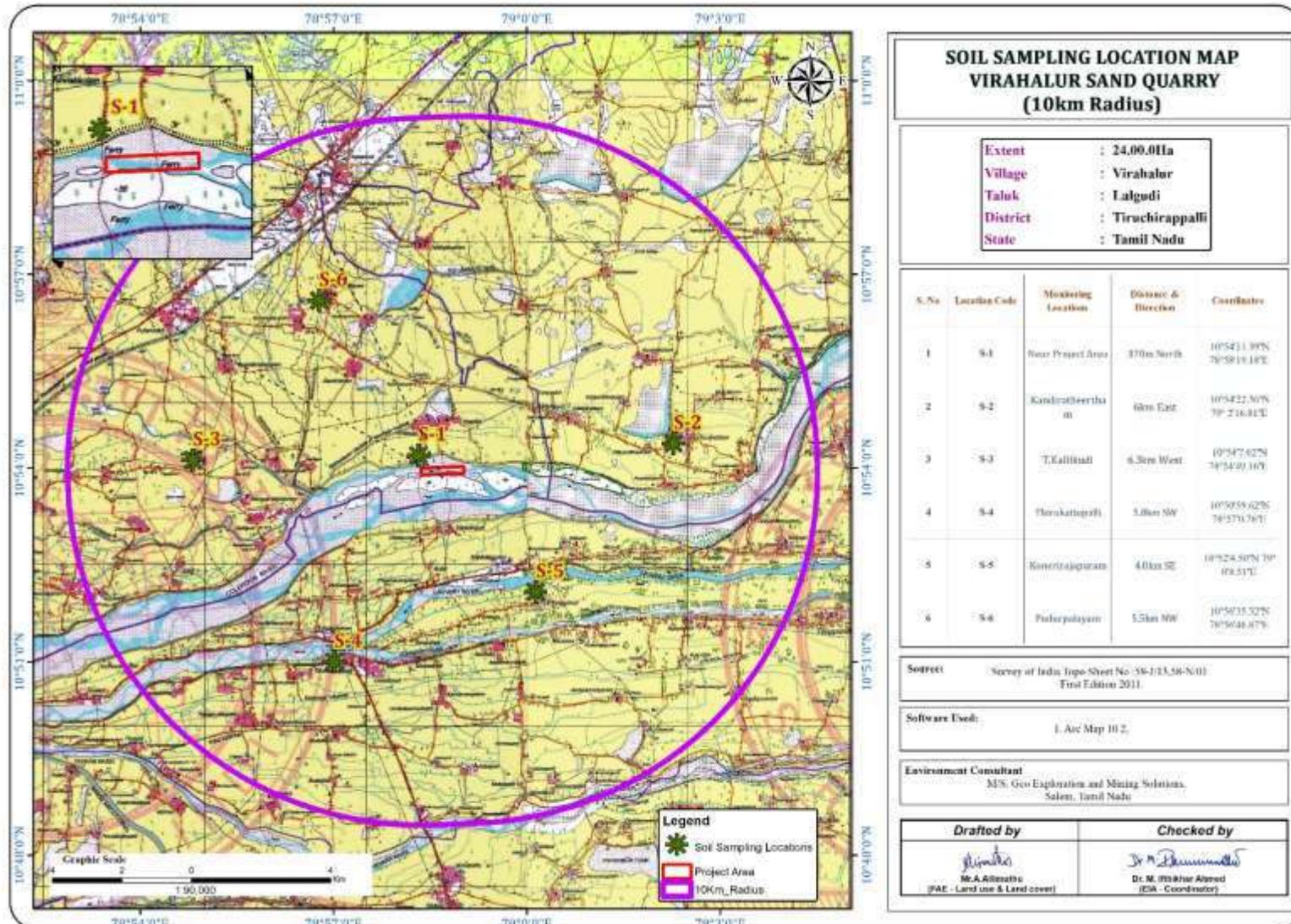


Figure 3.5: Soil Map of the study area

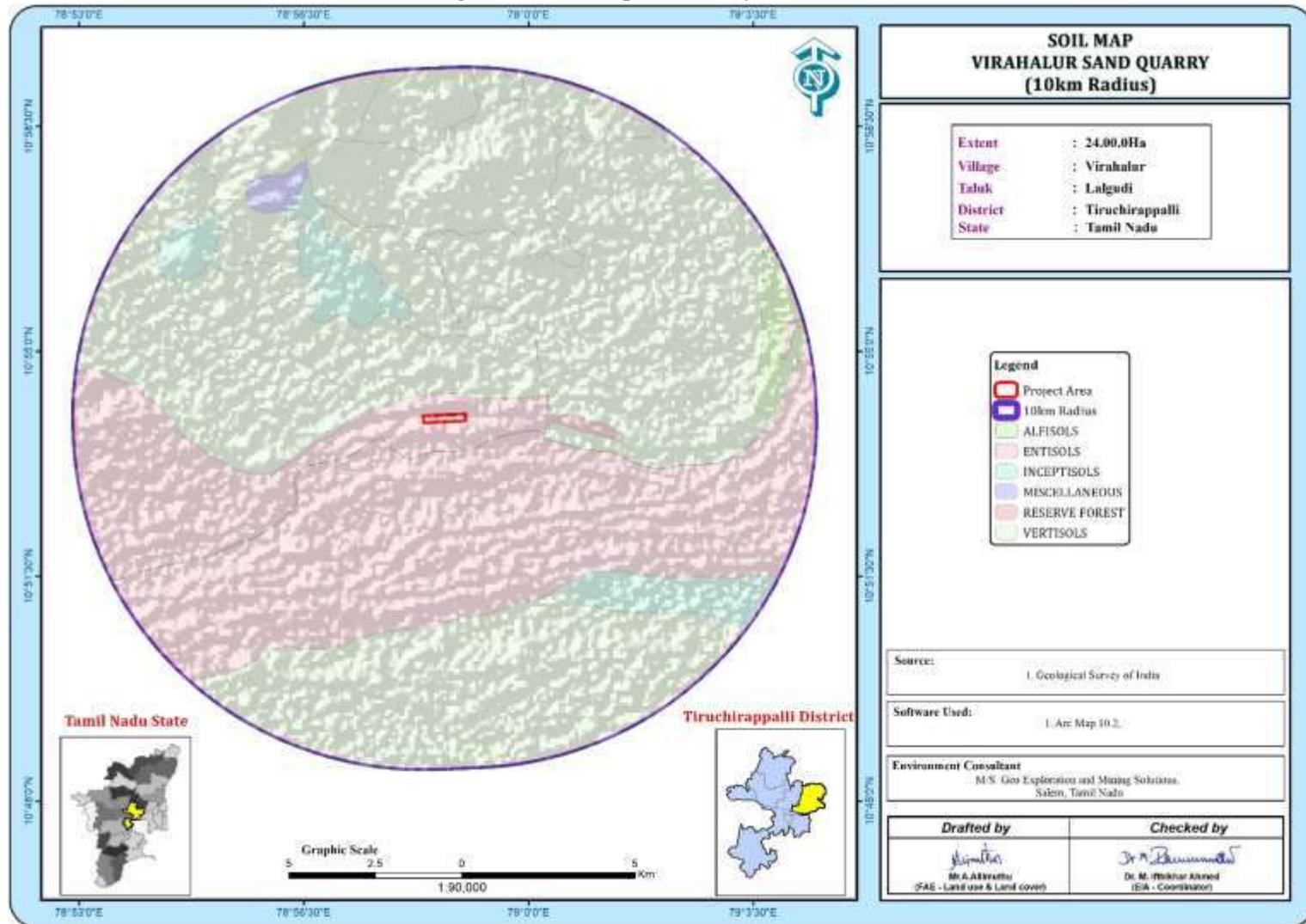


Table 3.7: Soil sampling results

| S.No | Test Parameters | units | S1 | S2 | S3 | S4 | S5 | S6 |
|------|-------------------------------------|-------------------|----------------|----------------|----------------|----------------|----------------|----------------|
| 01 | pH @ 25°C | - | 8.21 | 7.99 | 7.85 | 8.04 | 7.76 | 8.11 |
| 02 | Conductivity @ 25°C | µmhos/cm | 524 | 512 | 478 | 364 | 451 | 476 |
| 03 | Water Holding Capacity | % | 48.23 | 46.3 | 45.8 | 44.8 | 47.2 | 48.5 |
| 04 | Bulk Density | g/cm ³ | 1.13 | 1.16 | 1.09 | 0.92 | 1.04 | 1.06 |
| 05 | Porosity | % | 43.75 | 42.9 | 44.7 | 42.7 | 42.6 | 43.7 |
| 06 | Calcium as Ca | mg/kg | 158 | 142 | 89.5 | 159 | 127 | 132.7 |
| 07 | Magnesium as Mg | mg/kg | 62.7 | 50.71 | 33.14 | 61.1 | 70.55 | 72.8 |
| 08 | Chloride as Cl | mg/kg | 112.8 | 128 | 119 | 102.4 | 113 | 116.4 |
| 09 | Soluble Sulphate as SO ₄ | % | 0.011 | 0.0012 | 0.019 | 0.0021 | 0.0042 | 0.0046 |
| 10 | Total Phosphorus as P | mg/kg | 1.4 | 1.41 | 2.1 | 1.92 | 2.71 | 2.93 |
| 11 | Total Nitrogen as N | mg/kg | 346 | 319 | 378 | 381 | 372 | 385 |
| 12 | Organic Matter | % | 1.12 | 1.74 | 2.22 | 2.43 | 2.19 | 2.34 |
| 13 | Organic Carbon | % | 0.65 | 1.01 | 1.29 | 1.41 | 1.27 | 1.36 |
| 14 | Texture | | | | | | | |
| | Clay | % | 36.8 | 35.2 | 34.1 | 31.2 | 34.1 | 34.6 |
| | Sand | % | 34.6 | 37.5 | 37.9 | 38.2 | 37.2 | 36.1 |
| | Silt | % | 28.6 | 27.3 | 28.0 | 30.6 | 28.7 | 29.3 |
| 15 | Manganese as Mn | mg/kg | 22.9 | 24.8 | 26.4 | 23.6 | 22.3 | 25.2 |
| 16 | Zinc as Zn | mg/kg | 1.02 | 2.1 | 2.17 | 1.15 | 1.29 | 1.32 |
| 17 | Boron as B | mg/kg | 2.1 | 1.98 | 1.93 | 1.75 | 1.47 | 1.61 |
| 18 | Potassium as K | mg/kg | 29.9 | 26.8 | 38.3 | 42.4 | 32.4 | 34.4 |
| 19 | Cadmium as Cd | mg/kg | BDL (DL : 1.0) |
| 20 | Total Chromium as Cr | mg/kg | BDL (DL : 1.0) |
| 21 | Copper as Cu | mg/kg | BDL (DL : 1.0) |
| 22 | Lead as Pb | mg/kg | 0.87 | 0.91 | 1.07 | 1.04 | 1.32 | 1.27 g |
| 23 | Iron as Fe | mg/kg | 2.17 | 3.84 | 2.67 | 2.75 | 2.71 | 2.96 |
| 24 | Cation Exchange Capacity | meq/100g of soil | 32.7 | 39.4 | 36.7 | 38.21 | 41.5 | 43.4 |

Source: Sampling Results by EHS 360 Labs Private Limited 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 to Sandy Soil and Bulk Density of Soils in the study area varied between 0.92 – 1.16 g/cc. The Water Holding Capacity and Porosity of the soil samples is found to be medium i.e. ranging from 42.6 to 44.7.

Chemical Characteristics –

- The nature of soil is slightly alkaline to strongly alkaline in nature with pH range 7.76 to 8.21
- The available Nitrogen content range between 319 mg/kg to 385 mg/kg
- The available Phosphorus content range between 1.4 to 2.93 kg/ha
- The available Potassium range between 26.8 to 42.4 mg/kg

Whereas, the micronutrient as zinc (Zn), iron (Fe) and copper (Cu) were found in the range of 1.02 to 2.17 mg/kg; 2.17 to 3.87 mg/kg and ND

Wilting co efficient in significant level would mean that the soil would support the vegetation. The soil properties in the buffer zone reveal that the soil can sustain vegetation. If amended suitability the core area can also withstand plantation.

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

The project area lies in the Coleroon river. The area is studded with few tanks that serve as the source of drinking water and also their surplus feeds adjoining tanks.

3.2.2 Ground Water Conditions

Tiruchirappalli district is underlain entirely by Archaean Crystalline formations with Recent alluvial deposits occurring along the river and streams courses and colluvium of valley-fills. The important aquifer systems in the district are constituted by weathered, fissured and fractured crystalline rocks and the recent alluvial deposits.

Ground water occurs under phreatic conditions. The maximum saturated thickness of these aquifers is upto 5 m depending upon the topographic conditions. The study area falls in the Tiruchirappalli which is categorized as Safe (< 70%) as per G.O (MS) No 113 dated 09.06.2016.

There are six (6) bore wells within the radius of 2km Most of the wells are almost in dry conditions in the summer season. The details of the well and depth in monsoon and non-monsoon is described below

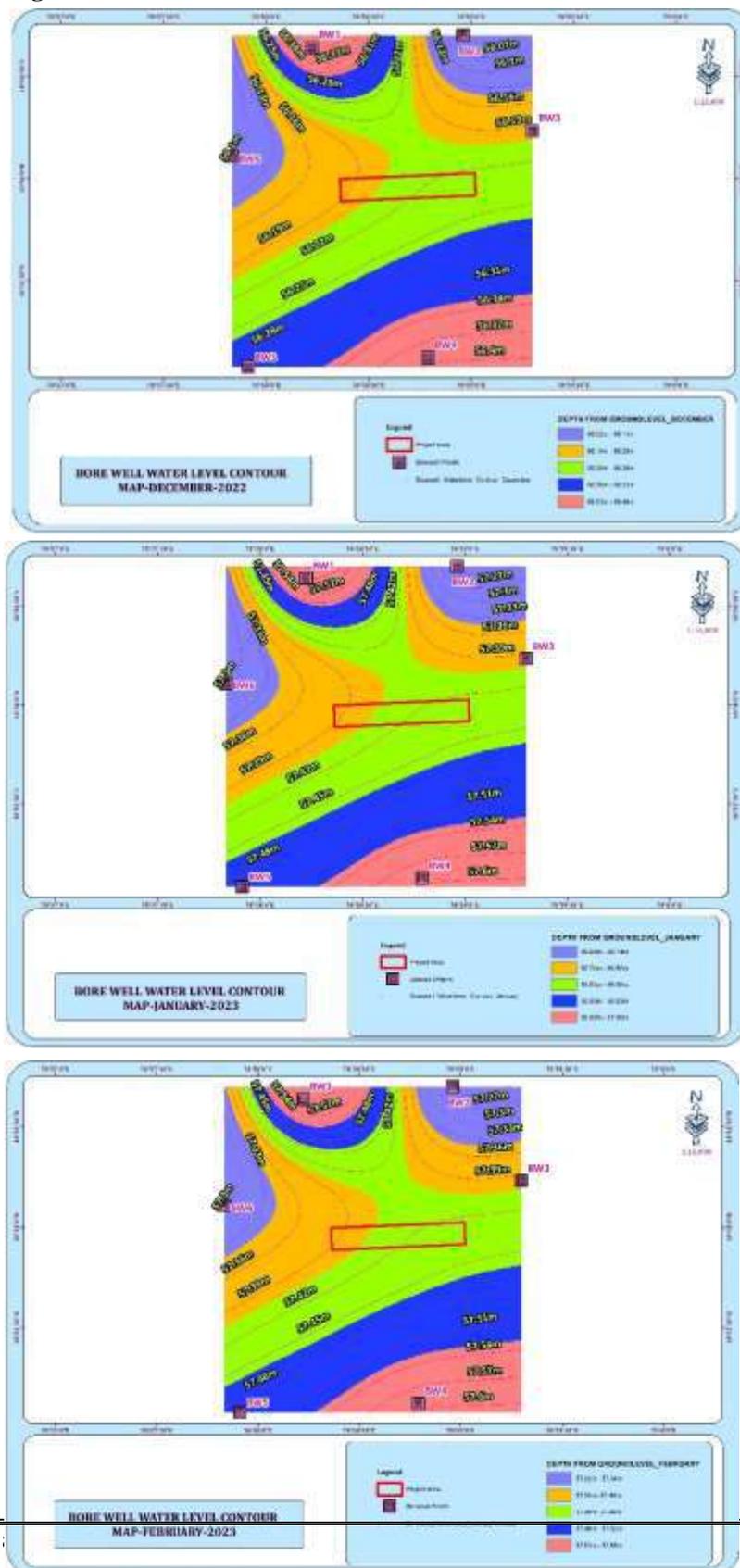
Table 3.8: Details of Bore well in 2km Radius

| S.No | Name | Latitude | Longitude | Dec-2022 (m) | Jan-2023 (m) | Feb-2023(m) |
|------|------|-----------------|-------------------|--------------|--------------|-------------|
| 1 | BW1 | 10° 54' 38.27"N | 10° 54' 38.27"N"E | 56.5 | 57.1 | 57.7 |
| 2 | BW2 | 10° 54' 41.98"N | 10° 54' 41.98"N"E | 56 | 56.6 | 57.2 |
| 3 | BW3 | 10° 54' 13.88"N | 10° 54' 13.88"N"E | 56.2 | 56.8 | 57.4 |
| 4 | BW4 | 10° 53' 07.41"N | 10° 53' 07.41"N"E | 56.4 | 57 | 57.6 |
| 5 | BW5 | 10° 53' 04.77"N | 10° 53' 04.77"N"E | 56.3 | 56.9 | 57.5 |
| 6 | BW6 | 10° 54' 06.37"N | 10° 54' 06.37"N"E | 56.1 | 56.7 | 57.3 |



Source : Data obtained by the FAE & Team Members

Figure 3.6: Winter Season Water Level of Bore Wells 2 Km Radius



Methodology for sample collection –

The sample was collected and analyzed as per IS-10500; IS-3025 & IS-2488 (Part 1-5). Grab sample of water was collected. Sample for chemical analysis was collected in polyethylene carboys. Sample for bacteriological analysis was collected in the sterilized bottle. Specified physio-chemical and Bacteriological parameters have been analyzed for projecting the existing water quality status in the study area.

Reconnaissance survey was undertaken to collect the sampling and locations were finalized based on;

1. Drainage pattern;
2. Location of residential areas representing different activities/likely impact areas; and
3. Likely areas, which can represent baseline conditions

Two (2) surface water and four (4) ground water samples were collected in the study area and physico-chemical, heavy metals and bacteriological parameters were analysed. The samples were analysed as per the procedures specified by CPCB, IS-10500:2012 and ‘Standard methods for the Examination of Water and Waste water’ 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 | Location code | Monitoring Locations | Distance & Direction | Coordinates |
|-------|---------------|----------------------|----------------------|-----------------------------|
| 1 | SW-1 | Kollidam River | Near Project Area | 10°54'2.03"N 78°59'7.96"E |
| 2 | SW-2 | Palanganatham Lake | 4.8km NW | 10°56'34.43"N 78°58'9.71"E |
| 3 | WW-1 | Alambakkam | 3.4km NW | 10°55'18.12"N 78°57'3.79"E |
| 4 | WW-2 | Vilagam | 6.3km NE | 10°56'49.24"N 79° 1'19.06"E |
| 5 | BW-1 | Viragalur | 1.2km North | 10°54'42.59"N 78°58'56.07"E |
| 6 | BW-2 | Thirukattupalli | 5.8km SW | 10°50'58.24"N 78°56'55.19"E |

Source: On-site monitoring/sampling by EHS 360 Labs Private Limited in association with GEMS

Note: SW- Surface water, WW – Well Water, BW – Bore well

Objective of Water sampling –

- * For rational planning of pollution control strategies and their prioritization
- * To assess nature and extent of pollution control needed in different water bodies or their part
- * To assess assimilative capacity of a water body thereby reducing cost on pollution control
- * To assess fitness of water for different uses

Figure 3.7: Water quality monitoring stations around 10km radius

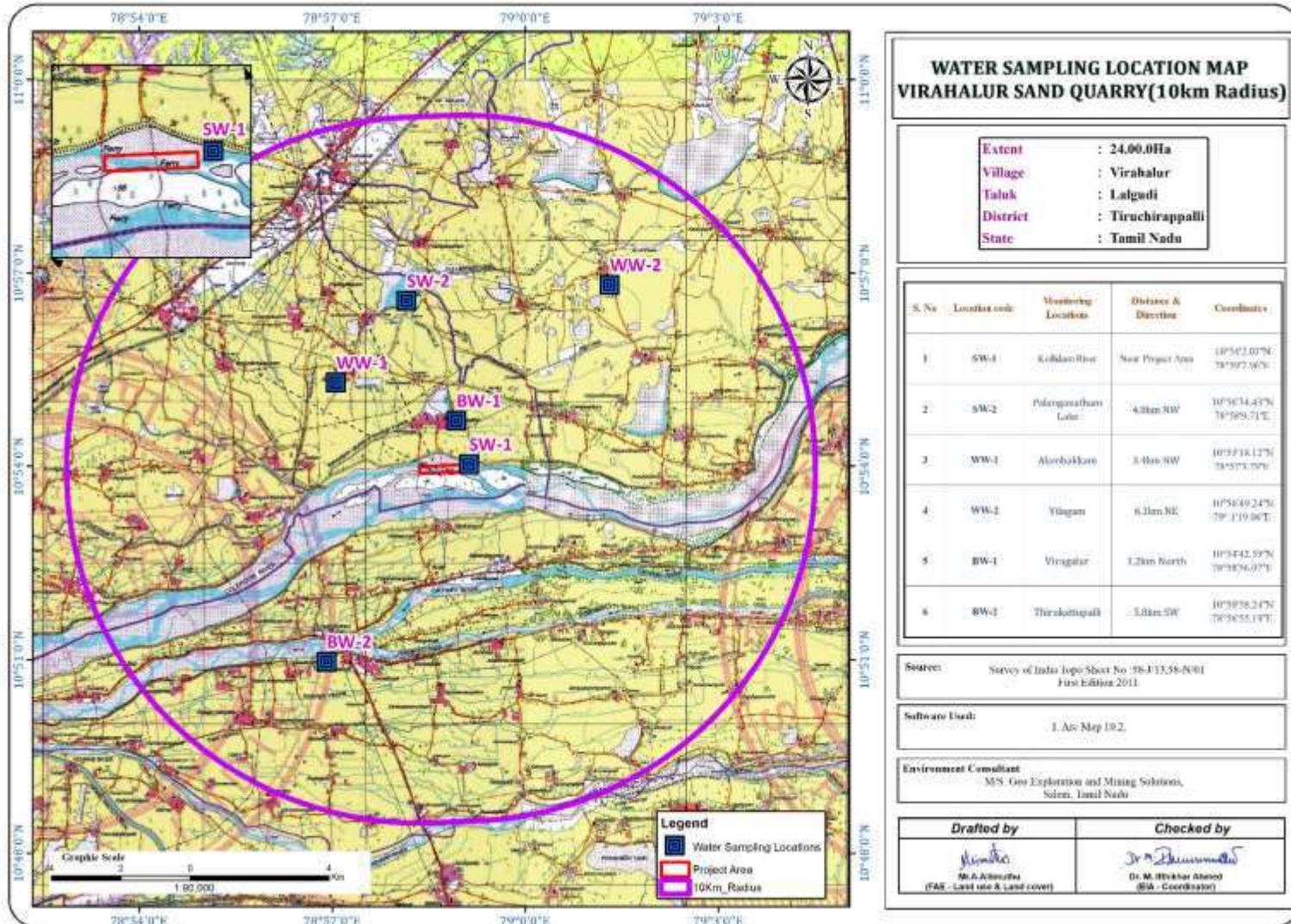


Figure 3.8: Ground Water Level Map

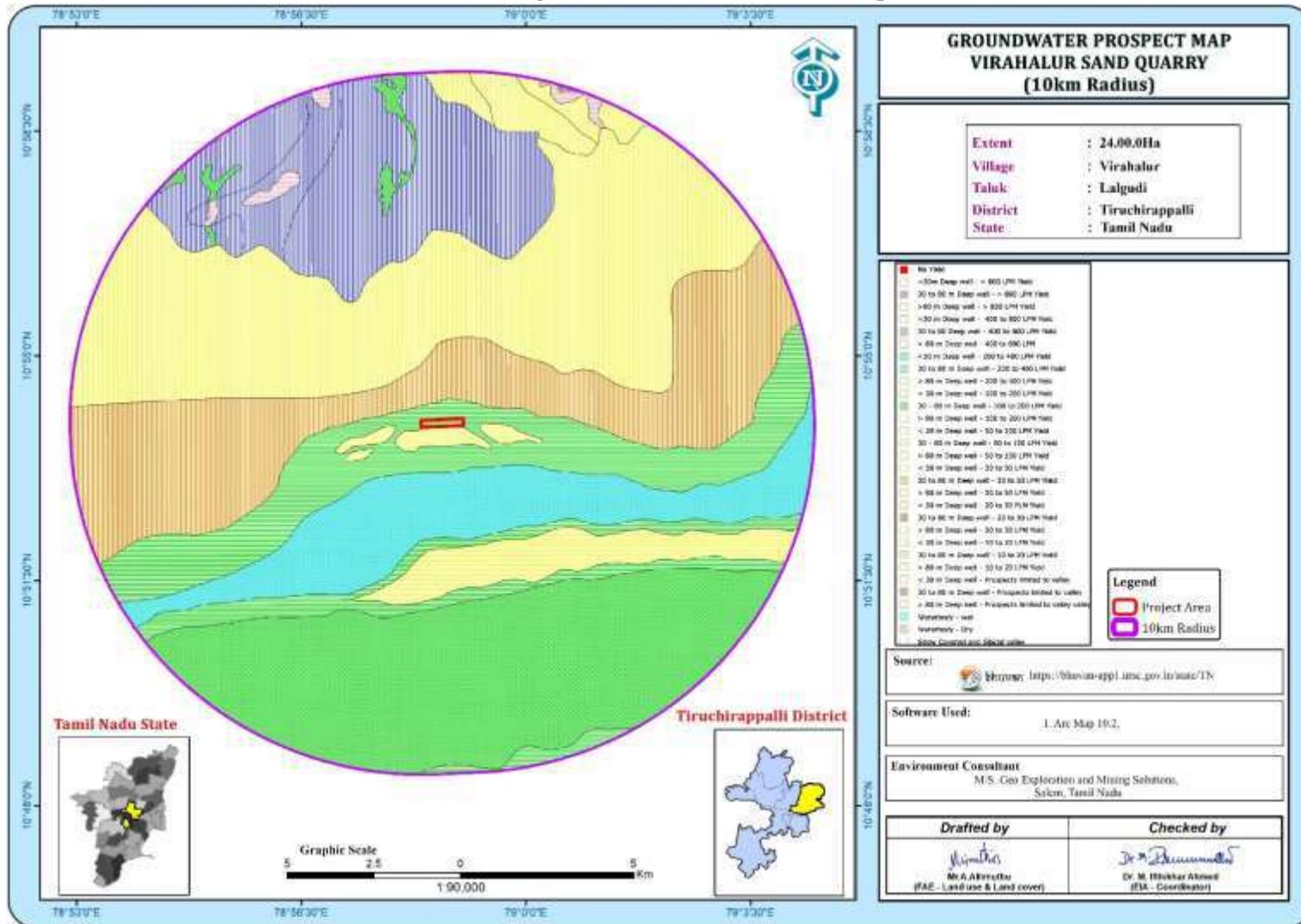


Figure 3.9: Drainage map of the study area - 10km radius

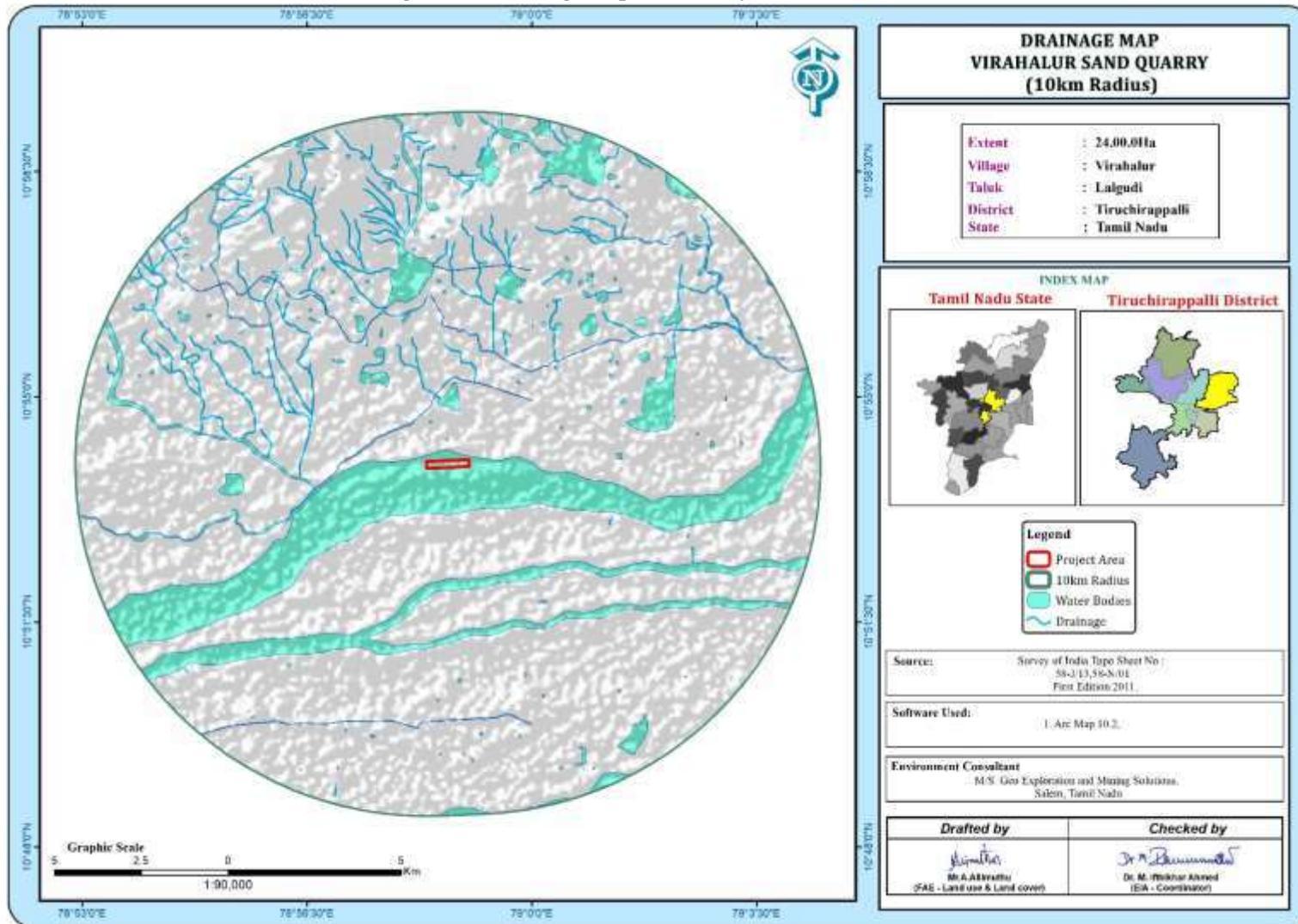


Table 3.10 – Surface Water Analysis Results

| S.No. | Parameters | Units | SW1 (Kollidam River) | SW2 (Palanganatham Lake) |
|-------|--|-----------|-----------------------|---------------------------|
| 1 | Colour | Hazen | 8 Hazen | 6 Hazen |
| 2 | Odour | - | Agreeable | Agreeable |
| 3 | pH at 25°C | - | 7.21 | 7.63 |
| 4 | Conductivity @ 25°C | µmhos/cm | 804 | 856 |
| 5 | Turbidity | NTU | 3.1 | 3.7 |
| 6 | Total Dissolved Solids | mg/l | 474 | 505 |
| 7 | Total Hardness as CaCO ₃ | mg/l | 220 | 224 |
| 8 | Calcium as Ca | mg/l | 62.5 | 59.3 |
| 9 | Magnesium as Mg | mg/l | 15.5 | 18.5 |
| 10 | Total Alkalinity as CaCO ₃ | mg/l | 192 | 196 |
| 11 | Chloride as Cl | mg/l | 112.7 | 116.8 |
| 12 | Sulphate as SO ₄ | mg/l | 68.2 | 59.4 |
| 13 | Iron as Fe | mg/l | 0.14 | 0.32 |
| 14 | Residual Free Chlorine | mg/l | BDL (DL:0.1) | BDL (DL:0.1) |
| 15 | Fluoride as F | mg/l | 0.23 | 0.21 |
| 16 | Nitrate as NO ₃ | mg/l | 9.8 | 13.4 |
| 17 | Copper as Cu | mg/l | BDL (DL:0.01) | BDL (DL:0.01) |
| 18 | Manganese as Mn | mg/l | BDL (DL:0.02) | BDL (DL:0.02) |
| 19 | Mercury as Hg | mg/l | BDL (DL:0.0005) | BDL (DL:0.0005) |
| 20 | Cadmium as Cd | mg/l | BDL (DL:0.001) | BDL (DL:0.001) |
| 21 | Selenium as Se | mg/l | BDL (DL:0.005) | BDL (DL:0.005) |
| 22 | Aluminium as Al | mg/l | BDL (DL:0.005) | BDL (DL:0.005) |
| 23 | Lead as Pb | mg/l | BDL (DL:0.005) | BDL (DL:0.005) |
| 24 | Zinc as Zn | mg/l | BDL(DL : 0.05) | BDL(DL : 0.05) |
| 25 | Total Chromium as Cr | mg/l | BDL(DL : 0.02) | BDL(DL : 0.02) |
| 26 | Boron as B | mg/l | BDL(DL : 0.05) | BDL(DL : 0.05) |
| 27 | Mineral Oil | mg/l | BDL(DL : 0.01) | BDL(DL : 0.01) |
| 28 | Phenolic compounds as C ₆ H ₅ OH | mg/l | BDL (DL:0.0005) | BDL (DL:0.0005) |
| 29 | Anionic Detergents (as MBAS) | mg/l | BDL (DL:0.01) | BDL (DL:0.01) |
| 30 | Cyanide as CN | mg/l | BDL (DL:0.01) | BDL (DL:0.01) |
| 31 | BOD @ 27°C for 3 days | mg/l | 11.2 | 9.6 |
| 32 | Chemical Oxygen Demand | mg/l | 36 | 32 |
| 33 | Dissolved Oxygen | mg/l | 6.5 | 7.1.2 |
| 34 | Barium as Ba | mg/l | BDL(DL:0.05) | BDL(DL:0.05) |
| 35 | Ammonia (as total ammonia-N) | mg/l | 1.7 | 3.2 |
| 36 | Sulphide as H ₂ S | mg/l | BDL (DL:0.01) | BDL (DL:0.01) |
| 37 | Molybdenum as Mo | mg/l | BDL (DL:0.02) | BDL (DL:0.02) |
| 38 | Total Arsenic as As | mg/l | BDL (DL:0.005) | BDL (DL:0.005) |
| 39 | Total Suspended Solids | mg/l | 15.4 | 19.3 |
| 40 | Total Coliform | MPN/100ml | 920 | 854 |
| 41 | <i>Escherichia coli</i> | MPN/100ml | 130 | 190 |

Source: Sampling Results by EHS 360 Labs Private Limited Laboratories

* 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 – Ground Water Analysis Results

| S.No. | Parameters | Units | WW1 (Alambakkam) | WW2 (Vilagam) | BW1 (Virahalir) | BW2 (Thirukattupalli) |
|-------|------------|-------|------------------|---------------|-----------------|-----------------------|
| 1 | Colour | - | 7 | 8 | 6 | 6 |
| 2 | Odour | - | Agreeable | Agreeable | Agreeable | Agreeable |
| 3 | pH at 25°C | - | 7.32 | 7.68 | 7.14 | 7.53 |

| | | | | | | |
|----|--|-----------|-----------------|-----------------|-----------------|-----------------|
| 4 | Conductivity @ 25°C | µmhos/cm | 887 | 788 | 778 | 807 |
| 5 | Turbidity | NTU | 3.3 | 2.8 | 1.9 | 1.37 |
| 6 | Total Dissolved Solids | mg/l | 523 | 465 | 459 | 476 |
| 7 | Total Hardness as CaCO ₃ | mg/l | 232 | 212 | 204 | 208 |
| 8 | Calcium as Ca | mg/l | 57.7 | 51.3 | 46.4 | 49.6 |
| 9 | Magnesium as Mg | mg/l | 21.4 | 20.4 | 21.4 | 20.4 |
| 10 | Total Alkalinity as CaCO ₃ | mg/l | 204 | 184 | 180 | 176 |
| 11 | Chloride as Cl | mg/l | 122.8 | 110.7 | 104 | 112.7 |
| 12 | Sulphate as SO ₄ | mg/l | 52.6 | 42.1 | 52.3 | 56.6 |
| 13 | Iron as Fe | mg/l | 0.26 | 0.24 | 0.14 | 0.17 |
| 14 | Residual Free Chlorine | mg/l | BDL (DL:0.1) | BDL (DL:0.1) | BDL (DL:0.1) | BDL (DL:0.1) |
| 15 | Fluoride as F | mg/l | 0.16 | 0.19 | 0.12 | 0.15 |
| 16 | Nitrate as NO ₃ | mg/l | 5.4 | 6.4 | 5.3 | 3.9 |
| 17 | Copper as Cu | mg/l | BDL (DL:0.01) | BDL (DL:0.01) | BDL (DL:0.01) | BDL (DL:0.01) |
| 18 | Manganese as Mn | mg/l | BDL (DL:0.02) | BDL (DL:0.02) | BDL (DL:0.02) | BDL (DL:0.02) |
| 19 | Mercury as Hg | mg/l | BDL (DL:0.0005) | BDL (DL:0.0005) | BDL (DL:0.0005) | BDL (DL:0.0005) |
| 20 | Cadmium as Cd | mg/l | BDL (DL:0.001) | BDL (DL:0.001) | BDL (DL:0.001) | BDL (DL:0.001) |
| 21 | Selenium as Se | mg/l | BDL (DL:0.005) | BDL (DL:0.005) | BDL (DL:0.005) | BDL (DL:0.005) |
| 22 | Aluminium as Al | mg/l | BDL (DL:0.005) | BDL (DL:0.005) | BDL (DL:0.005) | BDL (DL:0.005) |
| 23 | Lead as Pb | mg/l | BDL (DL:0.005) | BDL (DL:0.005) | BDL (DL:0.005) | BDL (DL:0.005) |
| 24 | Zinc as Zn | mg/l | BDL(DL : 0.05) | BDL(DL : 0.05) | BDL(DL : 0.05) | BDL(DL : 0.05) |
| 25 | Total Chromium as Cr | mg/l | BDL(DL : 0.02) | BDL(DL : 0.02) | BDL(DL : 0.02) | BDL(DL : 0.02) |
| 26 | Boron as B | mg/l | BDL(DL : 0.05) | BDL(DL : 0.05) | BDL(DL : 0.05) | BDL(DL : 0.05) |
| 27 | Mineral Oil | mg/l | BDL(DL : 0.01) | BDL(DL : 0.01) | BDL(DL : 0.01) | BDL(DL : 0.01) |
| 28 | Phenolic compounds as C ₆ H ₅ OH | mg/l | BDL (DL:0.0005) | BDL (DL:0.0005) | BDL (DL:0.0005) | BDL (DL:0.0005) |
| 29 | Anionic Detergents (as MBAS) | mg/l | BDL (DL:0.01) | BDL (DL:0.01) | BDL (DL:0.01) | BDL (DL:0.01) |
| 30 | Cyanide as CN | mg/l | BDL (DL:0.01) | BDL (DL:0.01) | BDL (DL:0.01) | BDL (DL:0.01) |
| 31 | Barium as Ba | mg/l | BDL(DL:0.05) | BDL(DL:0.05) | BDL(DL:0.05) | BDL(DL:0.05) |
| 32 | Ammonia (as total ammonia-N) | mg/l | BDL (DL:0.01) | BDL (DL:0.01) | BDL (DL:0.01) | BDL (DL:0.01) |
| 33 | Sulphide as H ₂ S | mg/l | BDL (DL:0.01) | BDL (DL:0.01) | BDL (DL:0.01) | BDL (DL:0.01) |
| 34 | Molybdenum as Mo | mg/l | BDL (DL:0.02) | BDL (DL:0.02) | BDL (DL:0.02) | BDL (DL:0.02) |
| 35 | Total Arsenic as As | mg/l | BDL (DL:0.005) | BDL (DL:0.005) | BDL (DL:0.005) | BDL (DL:0.005) |
| 36 | Total Suspended Solids | mg/l | BDL (DL:1.0) | BDL (DL:1.0) | BDL (DL:1.0) | BDL (DL:1.0) |
| 37 | Total Coliform | MPN/100ml | 136 | 152 | 172 | 126 |
| 38 | <i>Escherichia coli</i> | MPN/100ml | < 1.8 | < 1.8 | < 1.8 | < 1.8 |

* 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.

Source: Sampling Results by EHS 360 Labs Private Limited Laboratories



Conclusion: -

Methodologies adopted for sampling and analysis were according to the IS methods. The parameters thus analyzed were compared with IS 10500:2012.

Surface water

pH varied from 7.21 to 7.63 while turbidity found within the standards. Total Dissolved Solids varied from 474 to 505 mg/l and Chloride varied between 112.7mg/l to 116.8mg/l. Nitrates varied from 9.8 to 13.4 mg/l, while sulphates varied from 59.4 to 68.2 mg/l.

Ground water

The pH of the water samples collected ranged from 7.14 to 7.68 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 459 – 523 mg/l in all samples. The Total hardness varied between 204 mg/l – 232 mg/l for all samples. On Microbiological parameters, the water samples from all the locations meet the requirement. The parameters thus analyzed were compared with IS 10500:2012.

The quality of the surface and Ground water does not have any heavy metal concentration, acidic, Sulphur or suspended solid particles.

3.4 AIR ENVIRONMENT

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

3.4.1 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 3m 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 –

- Tiruchirappalli's climate is classified as tropical. The summers are much rainier than the winters in Tiruchirappalli. As per the Köppen-Geiger classification, the prevailing weather conditions in this region are categorized under Aw.
- The average temperature in Tiruchirappalli is 28.6 °C | 83.4 °F. The rainfall here is around 823 mm | 32.4 inch per year.
- Tiruchirappalli are in the middle of our planet and the summers are not easy to define. The best time to travel is January, February, October, November, December.
- The driest month is February, with 12 mm | 0.5 inch of rainfall. The greatest amount of precipitation occurs in November, with an average of 182 mm | 7.2 inch.
- The warmest month of the year is May, with an average temperature of 31.9 °C | 89.4 °F. The lowest average temperatures in the year occur in December, when it is around 24.8 °C | 76.6 °F.

Source: <https://en.climate-data.org/asia/india/tamil-nadu/tiruchirappalli-4207/>

Rainfall –

The average annual rainfall and the 5 years rainfall is as follows:

Table 3.12 – Rainfall Data

| Actual Rainfall In Mm | | | | | Normal Rainfall In Mm |
|-----------------------|-------|-------|-------|--------|-----------------------|
| 2017 | 2018 | 2019 | 2020 | 2021 | |
| 690.0 | 506.6 | 635.0 | 796.6 | 1222.7 | 985 |

Source: <https://www.twadboard.tn.gov.in/content/tiruchirappalli>

Table 3.13: Meteorological Data Recorded at Site

| S.No | Parameters | | Dec-2022 | Jan-2023 | Feb-2023 |
|------|-------------------------------|-----|----------|----------|----------|
| 1 | Temperature (⁰ C) | Max | 25.08 | 25.51 | 26.37 |
| | | Min | 21.26 | 21.35 | 24.26 |
| | | Avg | 23.17 | 23.43 | 25.31 |
| 2 | Relative Humidity (%) | Avg | 86.38 | 79.12 | 67.53 |
| 3 | Wind Speed (m/s) | Max | 5.7 | 4.67 | 4.9 |
| | | Min | 1.95 | 2.64 | 2.68 |
| | | Avg | 3.82 | 3.65 | 3.79 |
| 4 | Cloud Cover (OKTAS) | | 0-8 | 0-8 | 0-8 |
| 5 | Wind Direction | | ENE,NE | NE,ENE | ENE,ESE |

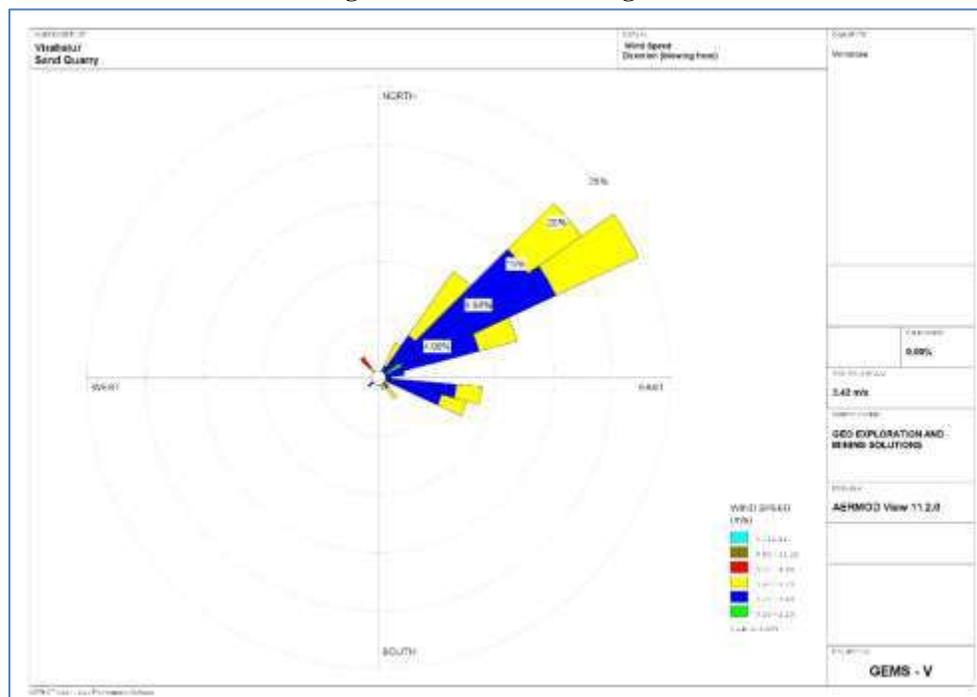
Source: Onsite monitoring data by EHS 360 Labs Private Limited Laboratories

Correlation between Secondary and Primary Data

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

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

Windrose diagram of the study site is depicted in Figure. 3.10. Predominant downwind direction of the area during study season is North East.

Figure 3.10: Windrose Diagram

In the abstract of collected data wind rose were drawn on presented in figure No.3.10 during the monitoring period in the study area

1. Predominant winds were from Northeast
2. Wind velocity readings were recorded between 0.50 to 5.70 km / hour
3. Calm conditions prevail of about 0.00% of the monitoring period
4. Temperature readings ranging from 21.26⁰ to 26.37⁰C
5. Relative humidity ranging from 67.53 to 83.38 %
6. The monitoring was carried out continuously for three months

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 Analysis

| Parameter | Method | Instrument |
|-------------------|---|---|
| PM _{2.5} | Gravimetric Method | Fine Particulate Sampler |
| | Beta attenuation Method | Make – Thermo Environmental Instruments – TEI 121 |
| PM ₁₀ | Gravimetric Method | Respirable Dust Sampler |
| | Beta attenuation Method | 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 EHS 360 Labs Private Limited Laboratories

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 (µg/m ³) | Annual Avg.* 24 hours** | 50.0 80.0 | 20.0 80.0 |
| 2 | Nitrogen Dioxide (µg/m ³) | Annual Avg. 24 hours | 40.0 80.0 | 30.0 80.0 |
| 3 | Particulate matter (size less than 10µm) PM ₁₀ (µg/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} (µg/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 December 2022 to February 2023. The baseline data of ambient air has been generated for PM₁₀, PM_{2.5}, Sulphur Dioxide (SO₂) & Nitrogen Dioxide (NO₂).

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 | Near Project Area | 230m North | 10°54'7.12"N 78°58'19.76"E |
| 2 | AAQ-2 | Poreyari | 1.4km South | 10°53'9.14"N 78°58'50.11"E |
| 3 | AAQ-3 | Kandiratheertham | 6km East | 10°54'27.58"N 79° 2'16.11"E |
| 4 | AAQ-4 | T.Kallikudi | 6.3km West | 10°54'8.15"N 78°54'49.42"E |
| 5 | AAQ-5 | Thirukattupalli | 5.8km SW | 10°51'2.82"N 78°56'56.29"E |
| 6 | AAQ-6 | Konerirajapuram | 4.0km SE | 10°52'4.95"N 79° 0'11.68"E |
| 7 | AAQ-7 | Pudurpalayam | 5.5km NW | 10°56'36.68"N 78°56'50.09"E |
| 8 | AAQ-8 | Vilagam | 6.5km NE | 10°56'56.80"N 79° 1'11.66"E |

Source: On-site monitoring/sampling by EHS 360 Labs Private Limited Laboratories with GEMS

Figure 3.11: Ambient Air Quality Monitoring Location Map

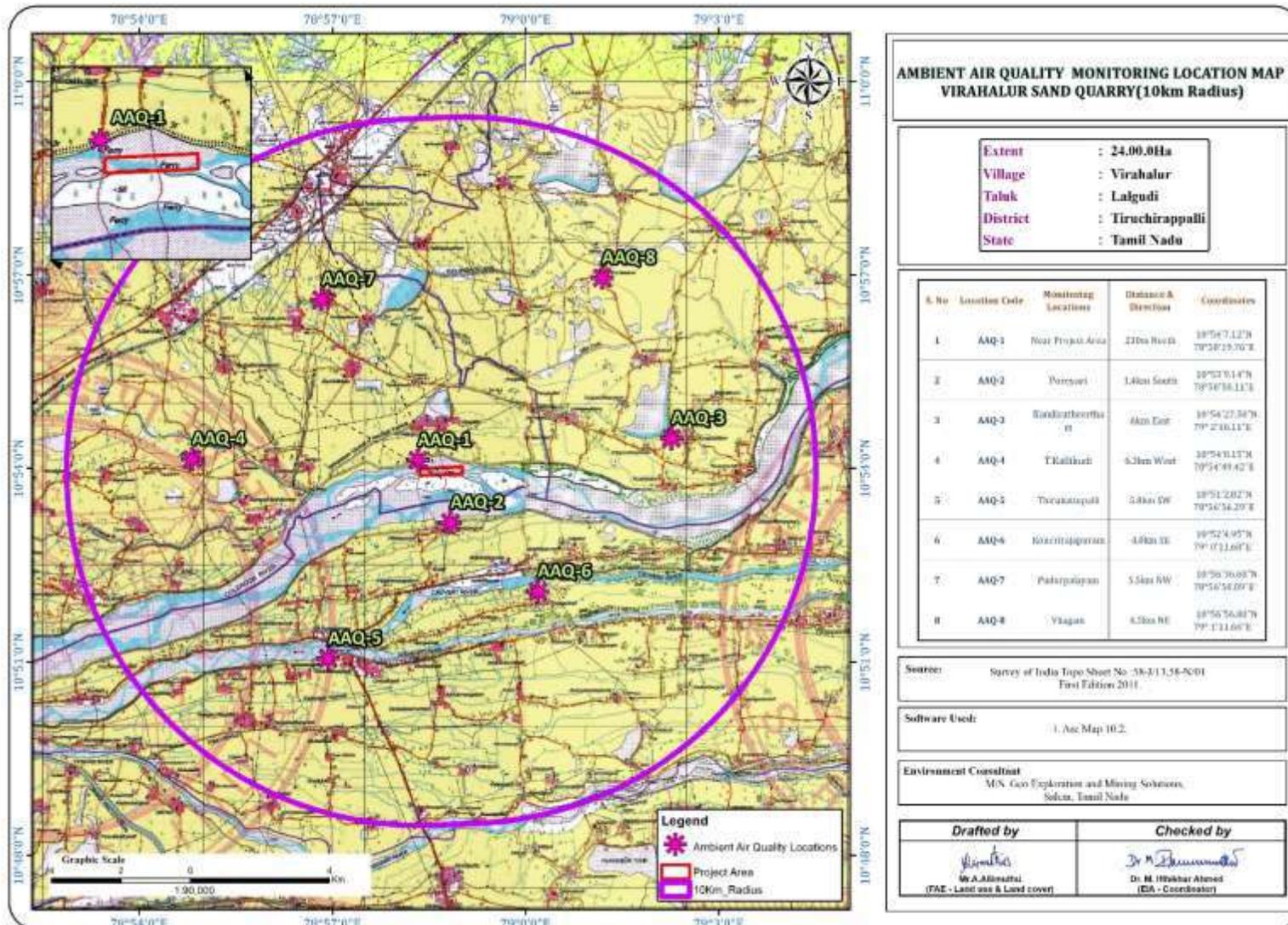
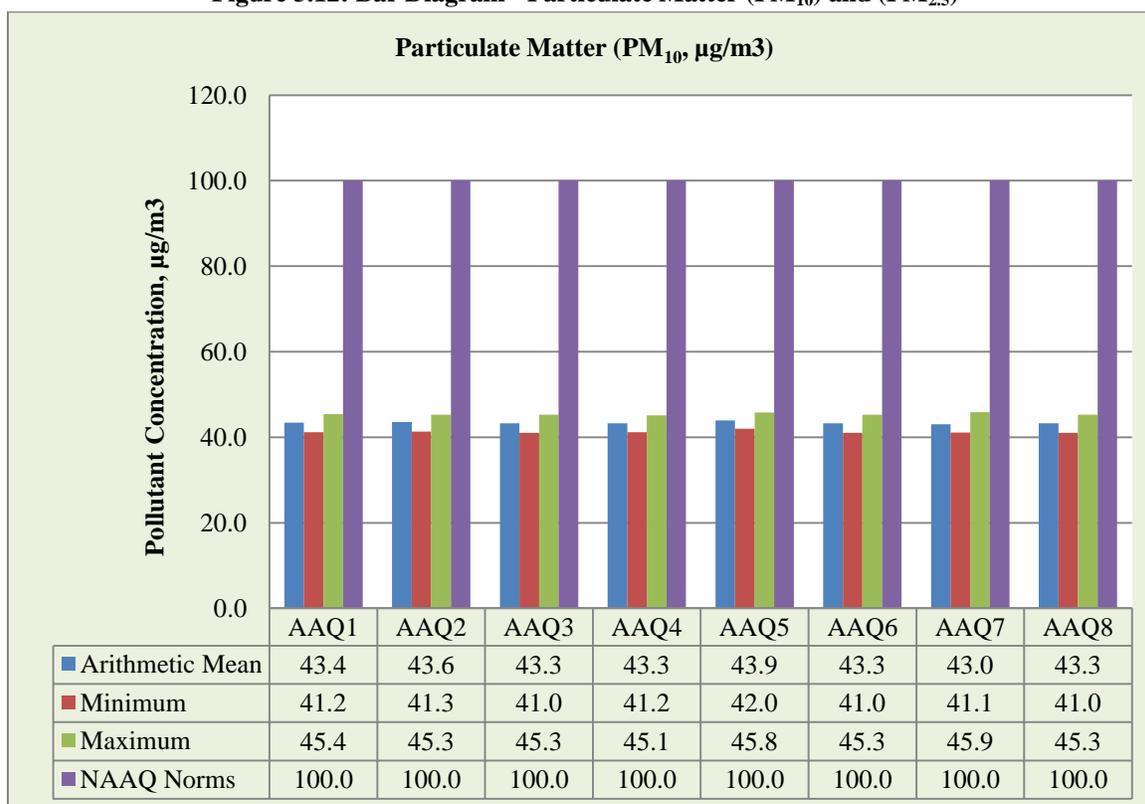
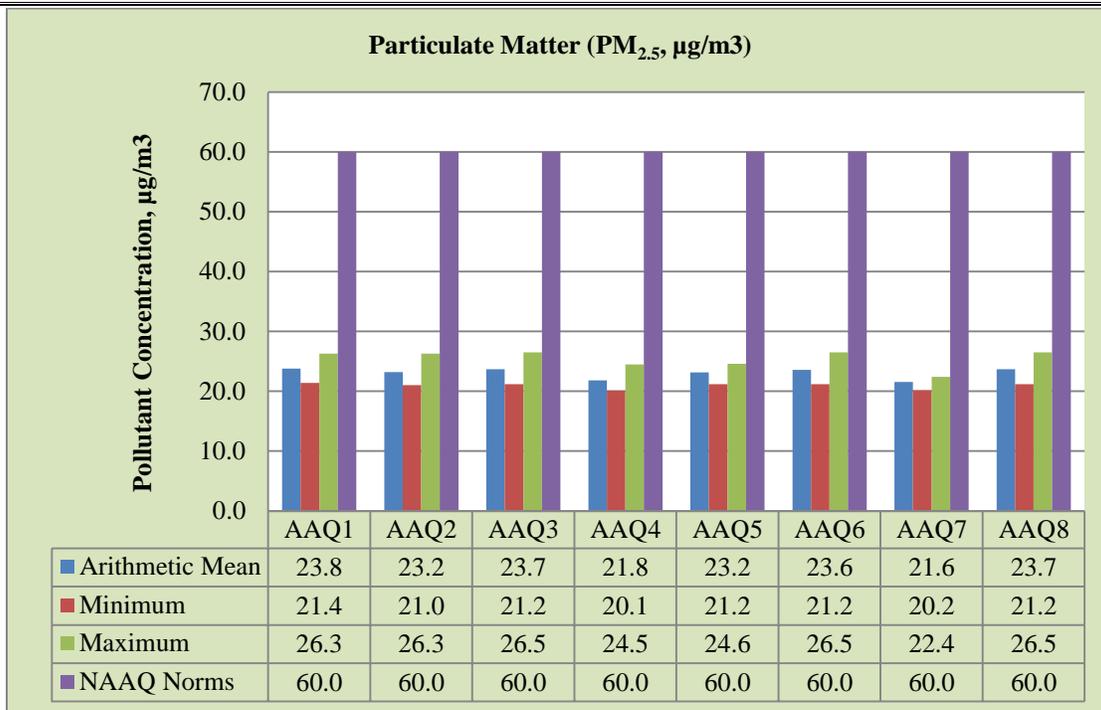
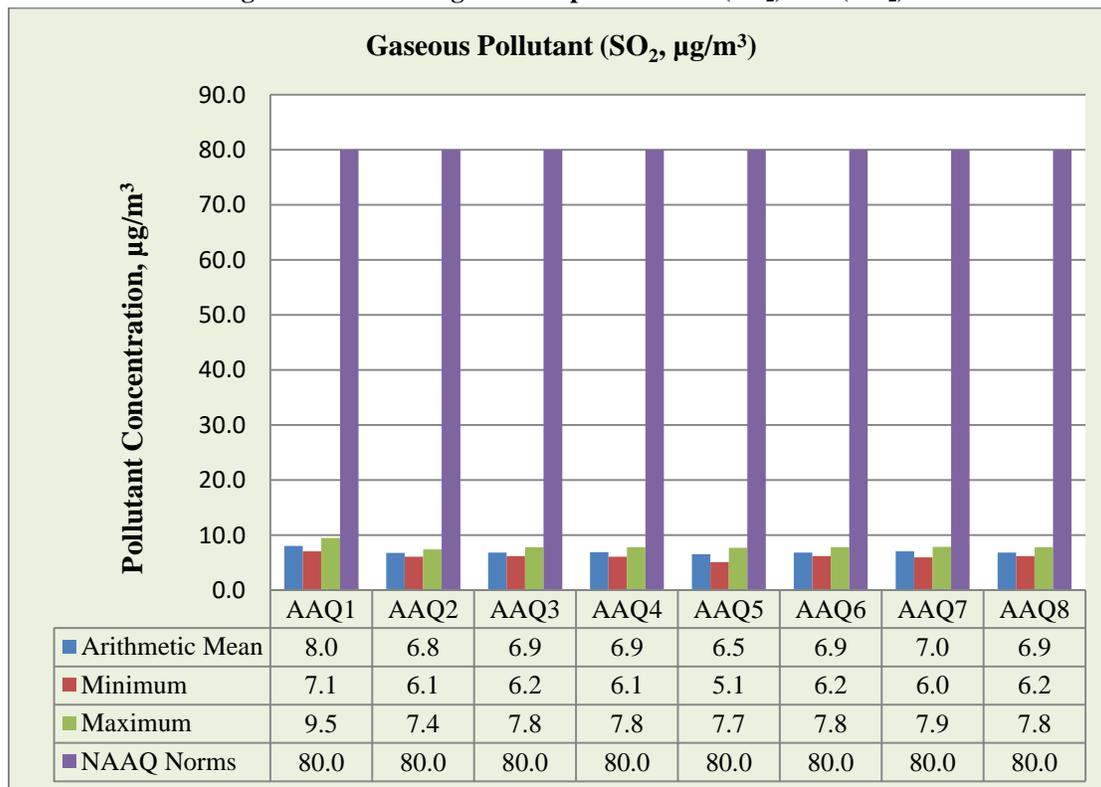
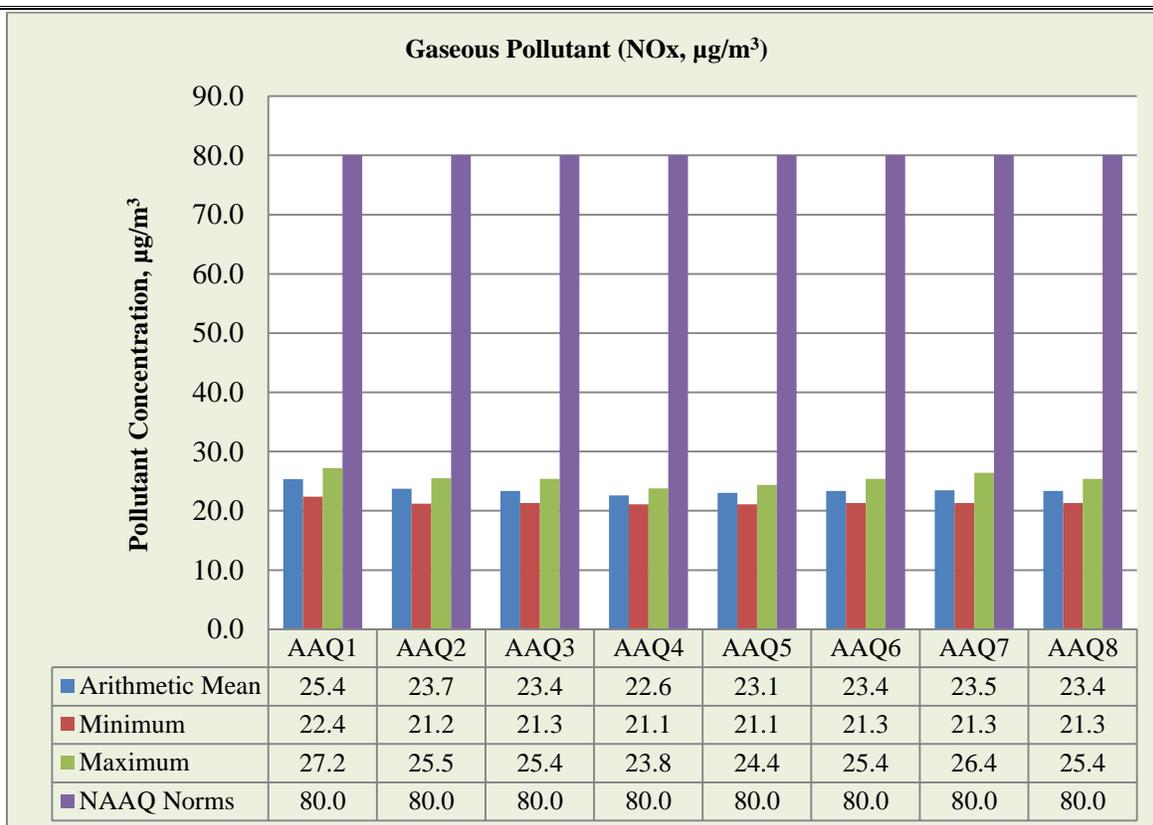


Table 3.17: Abstract of Ambient Air Quality Data

| 1 | Parameter | SPM | PM _{2.5} | PM ₁₀ | SO ₂ | NO ₂ |
|----|-----------------------------------|------|-------------------|------------------|-----------------|-----------------|
| 2 | No. of Observations | 208 | 208 | 208 | 208 | 208 |
| 3 | 10 th Percentile Value | 61.3 | 21.2 | 22.3 | 6.2 | 21.5 |
| 4 | 20 th Percentile Value | 63.5 | 21.5 | 41.5 | 6.4 | 22.3 |
| 5 | 30 th Percentile Value | 65.3 | 22.2 | 42.3 | 6.5 | 22.6 |
| 6 | 40 th Percentile Value | 66.3 | 22.3 | 42.6 | 6.8 | 23.2 |
| 7 | 50 th Percentile Value | 67.2 | 22.5 | 43.2 | 7.0 | 23.4 |
| 8 | 60 th Percentile Value | 67.3 | 23.5 | 43.6 | 7.2 | 23.7 |
| 9 | 70 th Percentile Value | 68.2 | 24.1 | 44.1 | 7.2 | 24.3 |
| 10 | 80 th Percentile Value | 69.2 | 24.5 | 44.5 | 7.4 | 24.8 |
| 11 | 90 th Percentile Value | 72.6 | 25.3 | 45.1 | 7.8 | 25.3 |
| 12 | 95 th Percentile Value | 73.5 | 26.2 | 45.3 | 8.3 | 25.8 |
| 13 | 98 th Percentile Value | 74.2 | 26.3 | 45.6 | 8.7 | 26.8 |
| 14 | Arithmetic Mean | 68.1 | 23.6 | 41.8 | 7.2 | 24.0 |
| 15 | Geometric Mean | 67.9 | 23.5 | 41.2 | 7.2 | 23.9 |
| 16 | Standard Deviation | 4.1 | 1.8 | 6.6 | 0.8 | 1.6 |
| 17 | Minimum | 61.3 | 21.2 | 22.3 | 6.2 | 21.5 |
| 18 | Maximum | 74.2 | 26.3 | 45.6 | 8.7 | 26.8 |
| 19 | NAAQ Norms* | - | 100.0 | 60.0 | 80.0 | 80.0 |
| | % Values exceeding Norms* | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

Figure 3.12: Bar Diagram - Particulate Matter (PM₁₀) and (PM_{2.5})

Figure 3.13: Bar Diagram - Sulphur dioxide (SO₂) and (NO₂)



Source: Table 3.11 & 3.12.

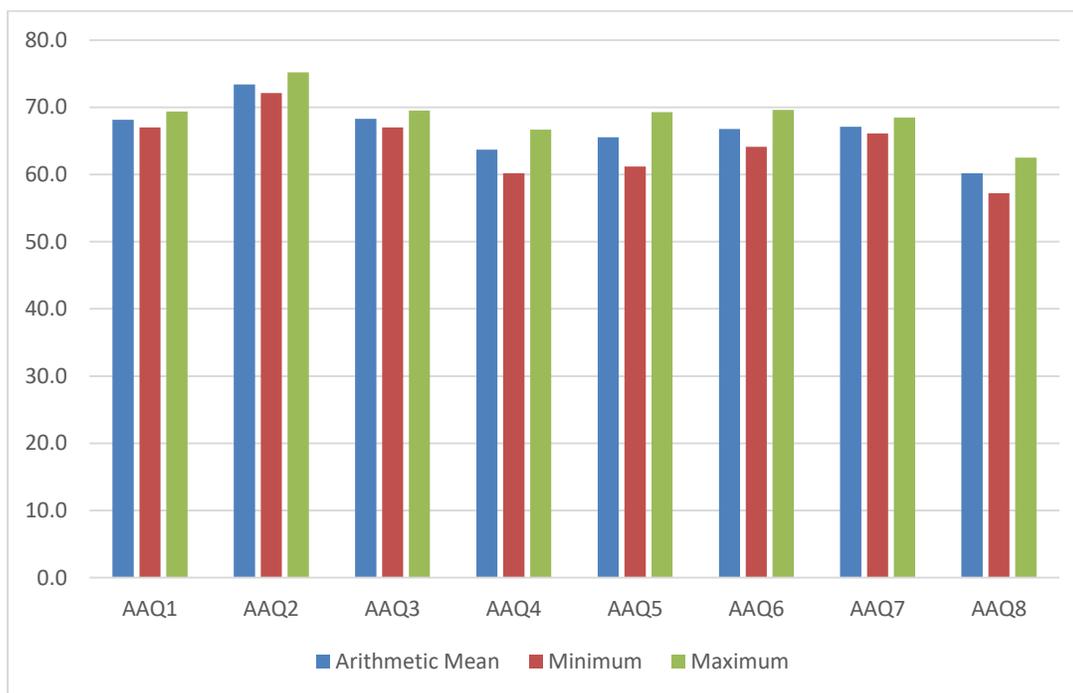
3.3.6 Interpretations & Conclusion

As per monitoring data, PM₁₀ ranges from 41.0 µg/m³ to 45.9 µg/m³, PM_{2.5} data ranges from 20.1 µg/m³ to 23.8 µg/m³, SO₂ ranges from 5.1 µg/m³ to 7.1 µg/m³ and NO₂ data ranges from 21.3 µg/m³ to 27.2 µg/m³. The concentration levels of the above criteria pollutants were observed to be well within the limits of NAAQS prescribed by CPCB.

The minimum & maximum concentrations of PM₁₀ were found to be 41.0 µg/m³ in Vilagam village & 45.9 µg/m³ in Pudurpalayam village respectively. The minimum & maximum concentrations of PM_{2.5} were found to be 20.1 µg/m³ in Thirukattupalli village & 23.8 µg/m³ in Project area respectively.

3.3.7 FUGITIVE DUST EMISSION –

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



Source: Line Diagram of Table 3.20

table 3.18– Fugitive Dust sample values in µg/m³

| SPM | AAQ1 | AAQ2 | AAQ3 | AAQ4 | AAQ5 | AAQ6 | AAQ7 | AAQ8 |
|-------------------|-------|-------|-------|-------|-------|-------|-------|-------|
| Arithmetic Mean | 68.1 | 73.4 | 68.3 | 63.7 | 65.5 | 66.8 | 67.1 | 60.2 |
| Minimum | 67.0 | 72.1 | 67.0 | 60.2 | 61.2 | 64.1 | 66.1 | 57.2 |
| Maximum | 69.4 | 75.2 | 69.5 | 66.7 | 69.3 | 69.6 | 68.5 | 62.5 |
| NAAQ Norms | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 |

Source: Calculations from Lab Analysis Reports

3.5 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.

3.5.1 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 10km. A noise monitoring methodology was chosen such that it best suited the purpose and objectives of the study.

Table 3.19 – Details of Surface Noise Monitoring Locations

| S. No | Location code | Monitoring Locations | Distance & Direction | Coordinates |
|-------|---------------|----------------------|----------------------|-----------------------------|
| 1 | N-1 | Near Project Area | 230m North | 10°54'6.94"N 78°58'19.83"E |
| 2 | N-2 | Poreyari | 1.4km South | 10°53'9.36"N 78°58'49.58"E |
| 3 | N-3 | Kandiratheertham | 6km East | 10°54'28.05"N 79° 2'15.63"E |
| 4 | N-4 | T.Kallikudi | 6.3km West | 10°54'8.44"N 78°54'50.48"E |
| 5 | N-5 | Thirukattupalli | 5.8km SW | 10°51'3.73"N 78°56'56.68"E |
| 6 | N-6 | Konerirajapuram | 4.0km SE | 10°52'3.77"N 79° 0'9.05"E |
| 7 | N-7 | Pudurpalayam | 5.5km NW | 10°56'36.95"N 78°56'50.91"E |
| 8 | N-8 | Vilagam | 6.5km NE | 10°56'56.73"N 79° 1'11.47"E |

Source: On-site monitoring/sampling by EHS 360 Labs Private Limited Laboratories with GEMS

3.5.2 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.

$$Leq = 10 \log L / T \sum (10L_n/10)$$

Where L = Sound pressure level at function of time dB (A)

T = Time interval of observation

3.5.3 Analysis of Ambient Noise Level in the Study Area

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



Figure 3.14: Noise Level monitoring Location Map

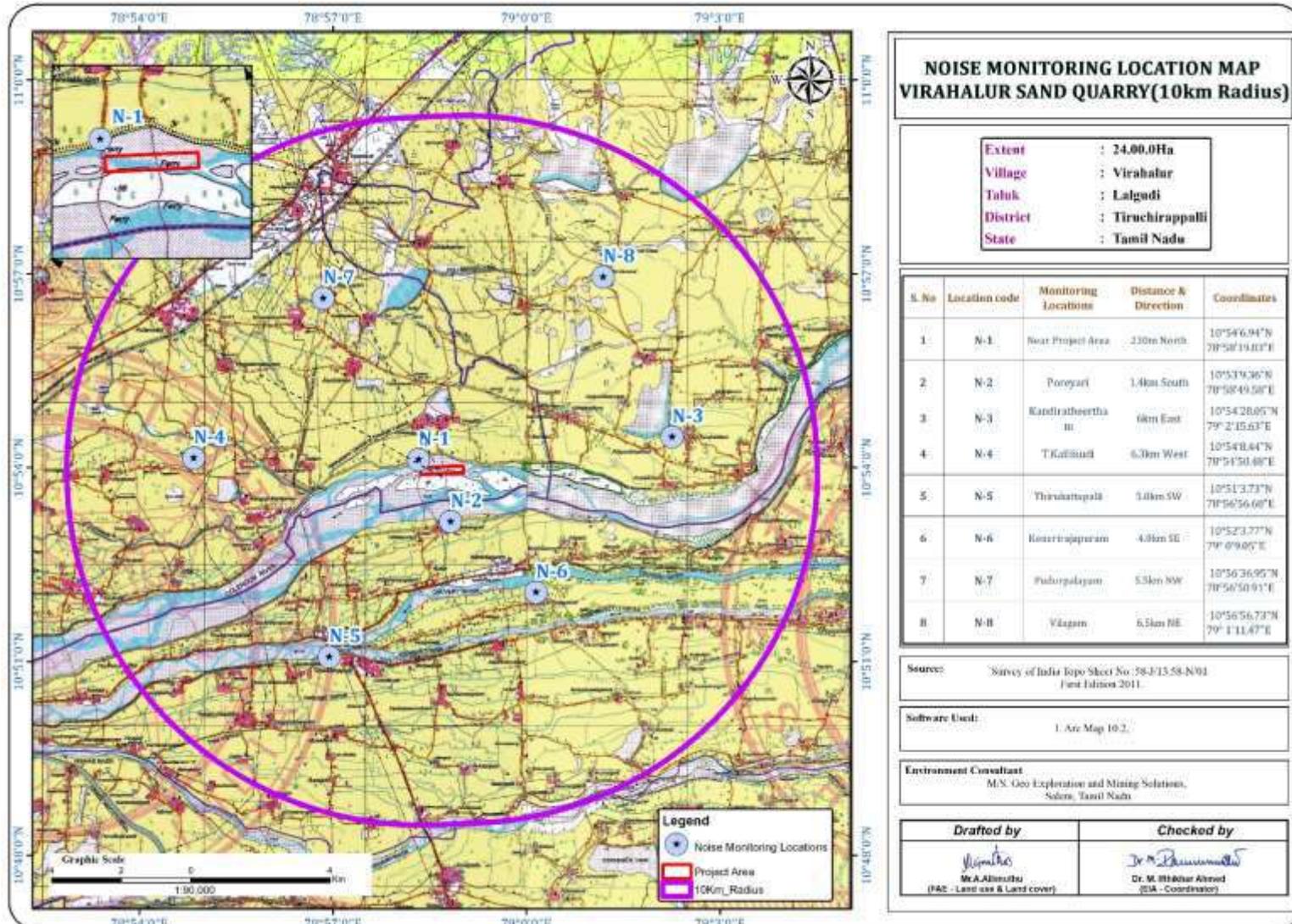
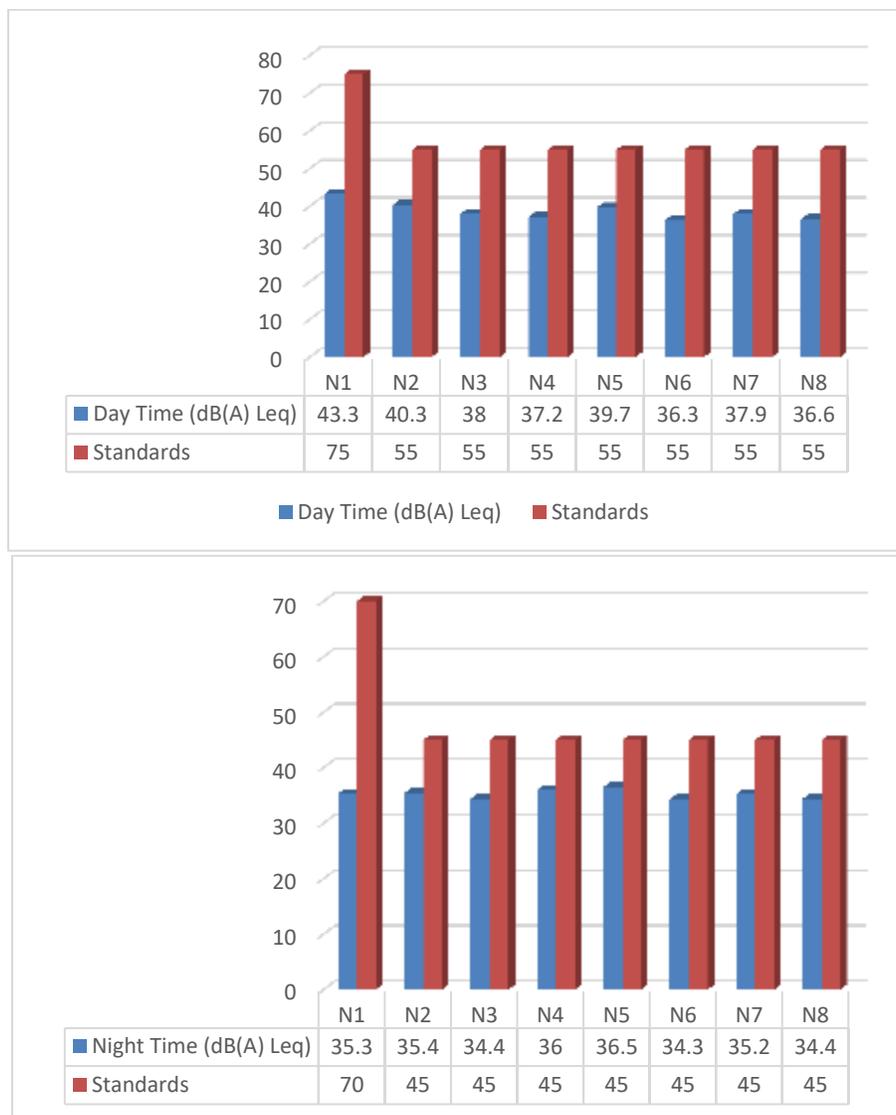


Table 3.20 – Noise Monitoring Results in Core and Buffer Zone

| S. No | Locations | Noise level (dB (A) Leq) | | Ambient Noise Standards |
|-------|-------------------|--------------------------|------------|---|
| | | Day Time | Night Time | |
| 1 | Near Project Area | 43.3 | 35.3 | Industrial Day Time- 75 dB (A) Night Time- 70 dB (A) Residential Day Time- 55 dB (A) Night Time- 45 dB (A) |
| 2 | Poreyari | 40.3 | 35.4 | |
| 3 | Kandiratheertham | 38.0 | 34.4 | |
| 4 | T.Kallikudi | 37.2 | 36.0 | |
| 5 | Thirukattupalli | 39.7 | 36.5 | |
| 6 | Konerirajapuram | 36.3 | 34.3 | |
| 7 | Pudurpalayam | 37.9 | 35.2 | |
| 8 | Vilagam | 36.6 | 34.4 | |

Source: On-site monitoring/sampling by EHS 360 Labs Private Limited in association with GEMS

Figure 3.15: Day & Night Time Noise Levels in Core and Buffer Zone



3.4.4 Interpretation & Conclusion:

Ambient noise levels were measured at 8 (eight) locations around the project area. Noise levels recorded in core zone during day time is 43.3 dB (A) Leq and during night time were from 35.3dB (A) Leq. Noise levels recorded in buffer zone during day time were from 36.3 – 40.3 dB (A) Leq and during night time were 34.4 – 36.5 dB (A) Leq.

The values of noise observed in some of the areas are primarily due to movement of vehicles and other anthropogenic activities. Thus, the noise level for Industrial and Residential area meets the requirements of CPCB.

3.6 BIOLOGICAL ENVIRONMENT

The study of the biological environment is one of the important aspects of Environmental Impact Assessments. The biotic component comprises both plant and animal communities which interact within the community and between themselves but also with abiotic i.e. physical and chemical components of the environment. A general ecological survey was carried out in the study area of 10 km radius around the Mine area. The study Area is not part of any National Park, Sanctuary, Biosphere Reserve, Wildlife Corridors, Migratory Path, etc. The primary data was generated by preparing a general checklist of all plants encountered in the study area. The species of vegetation found were identified and listed according to their families. The division of core and buffer zone is the best way to study the pattern of biodiversity for environmental impact assessment.

3.6.1 Objective of the study

The major objectives of the study were:

- * To document the diversity of the local flora within core & buffer zone.
- * To enlist the major agricultural crops, plantations and cultivated species.
- * To document the major fauna both invertebrate and vertebrate occurring in the selected 10Km study area.

The flora and fauna studies were carried out at randomly selected different sites representing the study area of 10 km radius. The detailed ecological assessment of the study area has been carried out with the following objectives:

- * Identification of flora and fauna within the study area;
- * Preparation of checklist of species which also include endangered, endemic and protected (both floral and faunal categories); and
- * Evaluation of impact of proposed expansion on flora and fauna of the area.

The ecological status of the study area has been assessed based on the following methodology:

- * 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.

3.6.2 Study approach & methodology adopted

The baseline study for existing ecological environment was carried out during December 2022 to February 2023. A participatory and consultative approach was followed. Field visits were undertaken for survey of the vegetation and animals in the study area. The study area has been divided in to two parts as core area consisting of project site and the buffer area as the 10 km radius of the project site.

3.6.3 Sampling Methodology

The main baseline survey was carried out to examine the current habitat and species composition. From December 2022 to February 2023, an ecology and biodiversity study was carried out within a 10-kilometer radius of the sand mine site. Plant taxonomy books, published literature and reports, and Websites (BSI, ZSI, and State/District Forest Departments) were used to identify the plant species. Also, information regarding vernacular names of plant species was gathered from local residents.

The Phyto-sociology study was carried out using the square quadrats technique through random sampling procedure. All the plots sampled were representative of the most common types of suitable areas. Quadrats of 10m x 10m for tree species, 5m x 5m for shrub species and 1m x 1m for herb species were used for sampling purposes.

Different sampling techniques were employed for documenting different faunal groups. For herpetofauna (Amphibians and Reptiles), visual encounter survey; for birds, point count and transect methods and for mammals direct, and indirect sightings (signs like tracks, pellets and pugmarks) were adopted. The water bodies in the area were also assessed for the status of the aquatic life and fishes.

3.6.4 Flora & Fauna at the study area

Table 3.21 : Flora in the Core zone of lease area (Kollidam River bed) Virahalur Village

| Sl.No | English Name | Vernacular Name | Scientific Name | Family Name |
|-----------------|---------------------------|-------------------|---------------------------------------|----------------|
| Trees | | | | |
| 1. | Velvet mesquite | Mullu maram | <i>Prosopis juliflora</i> | Fabaceae |
| Shrubs | | | | |
| 2. | Bush Morning Glory | Neiveli Kattamani | <i>Ipomoea carnea</i> | Convolvulaceae |
| 3. | Milk Weed | Erukku | <i>Calotropis gigantea</i> | Apocynaceae |
| 4. | Datura metel | Uumaththai | <i>Datura metel</i> | Solanaceae |
| Herbs | | | | |
| 5. | Cleome viscosa | Nai kadugu | <i>Celome viscosa</i> | Capparidaceae |
| 6. | Fish poison | Kolinch | <i>Tephrosia purpurea</i> | Fabaceae |
| 7. | Goatweed | Kallurukki | <i>Scoparia dulcis</i> | Plantaginaceae |
| 8. | Yellow-fruit nightshade | Kantang kathrikai | <i>Solanum virginianum</i> | Solanaceae |
| 9. | Spiny amaranth | Mullukkirai | <i>Amaranthus spinosus</i> | Amaranthaceae |
| 10. | East Indian globe thistle | kottai-k-karantai | <i>Sphaeranthus indicus</i> | Asteraceae |
| 11. | Holy basil | Thulasi | <i>Ocimum tenuiflorum</i> | Lamiaceae |
| 12. | Coat buttons | Thatha poo | <i>Tridax procumbens</i> | Asteraceae |
| 13. | Asthma-plant | Amman pacharisi | <i>Euphorbia hirta</i> | Euphorbiaceae |
| 14. | Indian doab | Arugampul | <i>Cynodon dactylon</i> | Poaceae |
| 15. | Common leucas | Thumbai | <i>Leucas aspera</i> | Lamiaceae |
| 16. | Rough cocklebur | Marul-umattai | <i>Xanthium strumarium</i> | Asteraceae |
| Grasses | | | | |
| 17. | Eragrostis | Pullu | <i>Eragrostis ferruginea</i> | Poaceae |
| 18. | Great brome | Thodappam | <i>Bromus diandrus</i> | Poaceae |
| 19. | Kans Grass | Wild sugarcane | <i>Saccharum spontaneum</i> | Poaceae |
| 20. | Softstem bulrush | - | <i>Schoenoplectus tabernaemontani</i> | Cyperaceae |
| 21. | Umbrella-sedge | Vattakorai | <i>Cyperus difformis</i> | Cyperaceae |
| 22. | Watergrass | Mukkutikorei | <i>Bulbostylis barbatta</i> | Cyperaceae |
| Creepers | | | | |
| 23. | Bitter Apple | Thumati kai | <i>Colocynthis citrullus</i> | Cucurbitaceae |
| 24. | Bayhops | Atappan-koti | <i>Ipomoea pes-caprae</i> | Convolvulaceae |

Fig No: 3.16. Flora species observation in the Core zone area



a. Tephrosia purpurea



b. Saccharum spontaneum



c. Xanthium strumarium



d. Ipomoea carnea



e. Celome viscosa



f. Datura metel



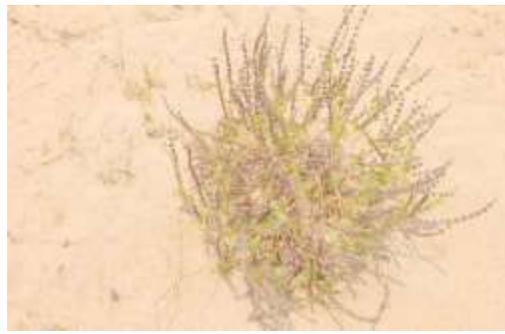
g. Sphaeranthus indicus



h. Amaranthus spinosus



i. Calotropis gigantea



l. Ocimum tenuiflorum



k. Scoparia dulcis



l. Prosopis juliflora



m. Colocynthis citrullus



n. ipomoea pes-caprae



o. Solanum virginianum



p. Cynodon dactylon

Flora in the buffer zone

Details of flora with scientific name observed in the buffer zone given in the table below.

Table 3.22 : List of Flora in the Buffer Zone

| S.No | English Name | Vernacular Name | Scientific Name | Family Name |
|--------------|-----------------------|------------------|---------------------------------|----------------|
| Trees | | | | |
| 1. | Neem or Indian lilac | Vembu | <i>Azadirachta indica</i> | Meliaceae |
| 2. | Acacia Nilotica | Karuvelam maram | <i>Vachellia nilotica</i> | Fabaceae |
| 3. | Asian Palmyra palm | Panai maram | <i>Borassus flabellifer</i> | Arecaceae |
| 4. | Tamarind | Puliyamaram | <i>Tamarindus indica</i> | Legumes |
| 5. | Millettia Pinnata | Pongam oiltree | <i>Pongamia pinnata</i> | Fabaceae |
| 6. | Gooseberry | Arai nelli | <i>Phyllanthus acidus</i> | Euphorbiaceae |
| 7. | Gum arabic tree | Karuvelam | <i>Acacia nilotica</i> | Mimosaceae |
| 8. | Indian plum | Elanthai maram | <i>Ziziphus mauritiana</i> | Rhamnaceae |
| 9. | Coconut | Thennai maram | <i>Cocos nucifera</i> | Arecaceae |
| 10. | Lemon | Ezhumuchaipalam | <i>Citrus lemon</i> | Rutaceae |
| 11. | Indian Mulberry | Manjanati | <i>Morinda coreia</i> | Rubiaceae |
| 12. | Drumstick tree | Karimurungai | <i>Moringa olefera</i> | Moraginaceae |
| 13. | Banana tree | Vazhaimaram | <i>Musa</i> | Musaceae |
| 14. | Senna siamea | Manjal Konnai | <i>Sennasiamea</i> | Fabaceae |
| 15. | Creamy Peacock Flower | Vadanarayani | <i>Delonix elata</i> | Fabaceae |
| 16. | Beauty leaf | Punnai | <i>Calophyllu inophyllum</i> | Calophyllaceae |
| 17. | Mango | Manga | <i>Mangifera indica</i> | Anacardiaceae |
| 18. | Indian fig tree | Athi | <i>Ficus recemosa</i> | Moraceae |
| 19. | Jujube | Ilanthai | <i>Ziziphus jujubha</i> | Rhamnaceae |
| 20. | Oil cake tree | Arappu | <i>Albizia amara</i> | Mimosaceae |
| 21. | Woman's tongue | Vagai | <i>Albizia lebbek</i> | Mimosaceae |
| 22. | Banyan tree | Alamaram | <i>Ficus benghalensis</i> | Moraceae |
| 23. | Rain Tree | Thoongu moonji | <i>Albizia saman</i> | Mimosaceae |
| 24. | Muntingia calabura | Singapore cherry | <i>Muntingiacalabura</i> | Malvaceae |
| 25. | Chinesh cheery | Thenpazham | <i>Muntingia calabura</i> | Tiliaceae |
| 26. | Indian bael | Vilvam | <i>Aegle marmelos</i> | Rutaceae |
| 27. | Umbrella thorn | Kodaivelam | <i>Acacia planifrons</i> | Mimosaceae |
| 28. | Henna | Marudaani | <i>Lawsonia inermis</i> | Lythraceae |
| 29. | Eucalyptus | Eucalyptus | <i>Eucalyptus globules</i> | Myrtaceae |
| 30. | Black plum | Navalmaram | <i>Sygygium cumini</i> | Myrtaceae |
| 31. | Jack fruit | Palamaram | <i>Artocarpus heterophyllus</i> | Moraceae |
| 32. | Curry tree | Karivembu | <i>Murraya kentia</i> | Rubiaceae |
| 33. | Robber-thorn tree | Anaimullu | <i>Acacia horrida</i> | Mimosaceae |
| 34. | Teak | Thekku | <i>Tectona grandis</i> | Verbenaceae |
| 35. | Indian gooseberry | Nelli | <i>Emblica officinalis</i> | Phyllanthaceae |
| 36. | Chinese chaste tree | Nochi | <i>Vote negundo</i> | Verbenaceae |
| 37. | Madras Thorn | Kuduka puli | <i>Pithecellobium dulce</i> | Mimosaceae |
| 38. | Cutch tree | Karungali | <i>Acacia sundra</i> | Legumes |
| 39. | Noni | Nuna maram | <i>Morinda citrifolia</i> | Rubiaceae |
| 40. | Five leaf chastera | Nochi | <i>Vitex negundo</i> | Lamiaceae |
| 41. | Papaya | Pappali maram | <i>Carica papaya L</i> | Caricaceae |
| 42. | Peepal | Arasanmaram | <i>Ficus religiosa</i> | Moraceae |
| 43. | Monoon longifolium | Nettilingam | <i>Polyalthia longifolia</i> | Annonaceae |

| 44. | Bamboo | Moonghil | <i>Bambusa bambo</i> | Poaceae |
|---------------|---------------------------|--------------------|-----------------------------------|----------------|
| Shrubs | | | | |
| 1. | Milk Weed | Erukku | <i>Calotropis gigantea</i> | Apocynaceae |
| 2. | Shoe flower | Chemparuthi | <i>Hibiscu rosa-sinensis</i> | Malvaceae |
| 3. | Avaram | Avarai | <i>Senna auriculata</i> | Fabaceae |
| 4. | Touch-me-not | Thottalchinungi | <i>Mimosa pudica</i> | Mimosaceae |
| 5. | Rosy Periwinkle | Nithyakalyani | <i>Cathranthus roseus</i> | Apocynaceae |
| 6. | Chrozophora tinctoria | Puramuttai | <i>Chrozophora rottleri</i> | Euphorbiaceae |
| 7. | Puriging nut | Kattamanakku | <i>Jatropha curcas</i> | Euphorbiaceae |
| 8. | Triangular spruge | Chaturakalli | <i>Euphorbia antiquorum</i> | Euphorbiaceae |
| 9. | Jackal jube | Surai Ilantai | <i>Ziziphus oenoplia</i> | Rhamnaceae |
| 10. | Plumeria alba | Malaiarali | <i>Plumeria alba</i> | Apocynaceae |
| 11. | Senna alata | Seemaigaththi | <i>Cassia alata</i> | Caesalpinaceae |
| 12. | Indian Oleander | Arali | <i>Nerium indicum</i> | Apocynaceae |
| 13. | Giant reed | Naanal | <i>Arunudo donax</i> | Poaceae |
| 14. | Malabar nut | Adathodai | <i>Justicia adhatoda</i> | Acanthaceae |
| 15. | Ipomoea cornea | Neivelikattamanaku | <i>Ipomoea carnea</i> | Convolvulaceae |
| 16. | Indian mallow | Thuthi | <i>Abutilon indicum</i> | Meliaceae |
| 17. | Solanum pubescens | Malaisundai | <i>Solanum pubescens</i> Willd | Solanaceae |
| 18. | Hygrophila spinosa | Neermulli | <i>Hydrophila auriculata</i> | Acanthaceae |
| 19. | Datura metel | Uumaththai | <i>Datura metel</i> | Solanaceae |
| 20. | Night shade plan | Sundaika | <i>Solanum torvum</i> | Solanaceae |
| 21. | Ceylon Date Palm | Icham | <i>Phoenix pusilla</i> | Arecaceae |
| Herbs | | | | |
| 1. | Gotu kola | Vallarai | <i>Centella asiatica</i> | Apiaceae |
| 2. | Common leucas | Thumbai | <i>Leucas aspera</i> | Lamiaceae |
| 3. | Holy basil | Thulasi | <i>Ocimum tenuiflorum</i> | Lamiaceae |
| 4. | Sessile joyweed | Ponnanganni | <i>Alternanthera sessilis</i> | Amaranthaceae |
| 5. | Cyperus difformis | Kudai koori | <i>Cyperus difformis</i> | Cyperaceae |
| 6. | Cat's claw | Thael Kodukku | <i>Martynia annua</i> | Pedaliaceae |
| 7. | Poor land flatsedg | Kunnakora | <i>Cyperus compressus</i> | Cyperaceae |
| 8. | Goatweed | Pumpillu | <i>Ageratum conyzoides</i> | Asteraceae |
| 9. | Mexican prickly poppy | Eli-yotti | <i>Argemone mexicana</i> | Papaveraceae |
| 10. | Indian doab | Arugampul | <i>Cynodon dactylon</i> | Poaceae |
| 11. | Chinese Spinach | Thandukeerai | <i>Amaranthus tricolor</i> | Amaranthaceae |
| 12. | Tridax daisy | Veetukaayapoond | <i>Tridax procumbens</i> | Asteraceae |
| 13. | Digeria muricata | Thoiya keerai | <i>Digeria muricata</i> | Amaranthaceae |
| 14. | Indian Copperleaf | Kuppaimeni | <i>Acalypha indica</i> | Euphorbiaceae |
| 15. | Chocolate weed | Punnakku poond | <i>Melochia corchorifolia</i> | Sterculiaceae |
| 16. | Riceweeds | Seruppada | <i>Coldenia procumbens</i> | Boraginaceae |
| 17. | Goatweed | Kallurukki | <i>Scoparia dulcis</i> | Plantaginaceae |
| 18. | East Indian globe thistle | kottai-k-karantai | <i>Sphaeranthus indicus</i> | Asteraceae |
| 19. | False daisy | Karisilanganni | <i>Eclipta prostrata</i> | Asteraceae |
| 20. | Carrot grass | Partiniyam | <i>Parthenium hysterophorus</i> | Asteraceae |
| 21. | Black Mustard Seed | Kaduku | <i>Brassica juncea</i> | Brassicaceae |
| 22. | Slender amaranth | Sirukeerai | <i>Amaranthus polygonoides</i> | Amaranthaceae |
| 23. | European black nightshade | Manathakkali | <i>Solanum nigrum</i> | Solanaceae |
| 24. | Cleome viscosa | Nai kadugu | <i>Celome viscosa</i> | Capparidaceae |



| | | | | |
|-----------------|--------------------------|---------------------------|----------------------------------|----------------|
| 25. | Prickly chaff flower | Nayuruv | <i>Achyranthes aspera</i> | Amaranthaceae |
| 26. | Punarnava | Mukkirattai | <i>Boerhaavia diffusa</i> | Nyctaginaceae |
| 27. | Prickly amaranth | Mullukkeerai | <i>Amaranthus spinosus</i> | Amaranthaceae |
| 28. | Porcupine flower | Kundan | <i>Barleria prionitis</i> | Acanthaceae |
| 29. | Billygoat weed | Pumpillu | <i>Ageratum conyzoides</i> | Asteraceae |
| Climbers | | | | |
| 1. | Butterfly-pea | Sangupoo | <i>Clitoriaternatia</i> | Fabaceae |
| 2. | Ivy gourd | Kovai | <i>Coccinia grandis</i> | Cucurbitaceae |
| 3. | Balloon vine | Mudakkotan | <i>Cardiospermum helicacabum</i> | Sapindaceae |
| 4. | Rosary pea | Kuntumani | <i>Abrus precatorius L</i> | Fabaceae |
| 5. | Pointed gourd | Kovakkai | <i>Trichosanthes dioica</i> | Cucurbitaceae |
| 6. | Indian sarsparilla | Nannari | <i>Hemidesmus indicus</i> | Asclepiadaceae |
| 7. | Coral vine | Kodi rose | <i>Antigonon leptopus</i> | Polygonaceae |
| 8. | Stemmed vine | Perandai | <i>Cissus quadrangularis</i> | Vitaceae |
| 9. | Wild jasmine | Malli | <i>Jasminum augustifolium</i> | Oleaceae |
| 10. | Bottle Guard | Sorakkai | <i>Lagenaria siceraria</i> | Cucurbitaceae |
| 11. | Bitter gourd | Pavakkai | <i>Momordica charantia</i> | Cucurbitaceae |
| Creepers | | | | |
| 1. | Ground Spurge | Sithrapaalavi | <i>Euphorbia prostrata</i> | Euphorbiaceae |
| 2. | Ipomoea reniformis chois | Elikkathilai | <i>Merremia gangetica</i> | Convolvulaceae |
| 3. | Bitter Apple | Thumattikai | <i>Cucumis callosus</i> | Cucurbitaceae |
| 4. | Merremia | Muthiyar koontha | <i>Merremia tridentata</i> | Convolvulaceae |
| 5. | Frog fruit | Poduthalai | <i>Phyla nodifolia</i> | Verbenaceae |
| Grasses | | | | |
| 1. | Apluda | Kattu kanchippul | <i>Apluda mutica</i> | Poaceae |
| 2. | Finger grass | Kuruthupillu | <i>Chloris dolichostachya</i> | Poaceae |
| 3. | Nut grass | Korai | <i>Cyperus rotandus</i> | Poaceae |
| 4. | Marvel grass | Marvel grass | <i>Dichanthium annulatum</i> | Poaceae |
| 5. | Jungle rice | Kuthirai vaal Kattu arusi | <i>Echinochloa colona</i> | Poaceae |
| 6. | Windmill grass | Chevvarakupul | <i>Chloris barbata</i> | Amaranthaceae |
| 7. | Eragrostis | Pullu | <i>Eragrostis ferruginea</i> | Poaceae |
| 8. | Umbrella-sedge | Vattakorai | <i>Cyperus difformis</i> | Cyperaceae |
| Cactus | | | | |
| 1. | Prickly pear | Nagathali | <i>Opuntia</i> | Cactaceae |
| 2. | Triangular spruge | Chaturakalli | <i>Euphorbia antiquorum</i> | Euphorbiaceae |

Fauna in the Core zone

The common insects are dragon fly, grass hoper ant scorpion, centipede, millipede, Butterflies, Indian Frags are found in the core zone.

Table 3.23 : List of Fauna in the Core Zone

| Sl.No | Scientific Name | Common Name | IUCN Red List data |
|-----------------|---------------------------------|---------------------------|--------------------|
| Insects | | | |
| 1. | <i>Trithemis pallidinervis</i> | Long legged marsh skimmer | LC |
| 2. | <i>Brachythemis contaminata</i> | Ditch jewel | LC |
| 3. | <i>Danaus genutia</i> | Striped Tiger | LC |
| 4. | <i>Diplocodes trivialis</i> | Ground skimmer | - |
| 5. | <i>Hieroglyphus sp</i> | Grasshopper | LC |
| Reptiles | | | |



| | | | |
|-------------|------------------------------|-----------------------|----|
| 1. | <i>Mabuya carinatus</i> | Common skink | LC |
| 2. | <i>Calotes versicolor</i> | Garden lizard | LC |
| Aves | | | |
| 1. | <i>Accipiter badius</i> | Shikra | LC |
| 2. | <i>Corvus splendens</i> | House crow | LC |
| 3. | <i>Alcedo atthis</i> | Small blue kingfisher | LC |
| 4. | <i>Dicrurus macrocercus</i> | Black drongo | LC |
| 5. | <i>Nycticorax nycticorax</i> | Night Heron | IV |
| 6. | <i>Bubulcus ibis</i> | Cattle egret | LC |
| 7. | <i>Saxicoloides fulicata</i> | Indian Robin | LC |
| 8. | <i>Milvus migrans</i> | Black kite | LC |

Fauna in the buffer zone

Details of fauna with scientific name observed in the buffer zone given in the table below.

Table 3.24: List of Fauna's in the buffer zone

Mammals:

| SI. No | Scientific Name | Common Name | IUCN Conservation Status |
|--------|----------------------------|----------------------|--------------------------|
| 1. | <i>Funambulus palmarum</i> | Indian palm squirrel | LC |
| 2. | <i>Mus booduga</i> | Indian Field Mouse | LC |
| 3. | <i>Herpestes javanicus</i> | Asian Small Mongoose | LC |
| 4. | <i>Rattus norvegicus</i> | Brown rat | LC |

Birds

| SI. No | Scientific Name | Common Name | IUCN Conservation Status |
|--------|------------------------------|-----------------------|--------------------------|
| 1. | <i>Dicrurus macrocercus</i> | Black drongo | LC |
| 2. | <i>Orthotomus sutorius</i> | Tailor Bird | IV |
| 3. | <i>Passer domesticus</i> | House Sparrow | LC |
| 4. | <i>Alcedo atthis</i> | Small blue kingfisher | LC |
| 5. | <i>Bubulcus ibis</i> | Cattle Egret | LC |
| 6. | <i>Saxicoloidesfulicata</i> | Indian Robin | LC |
| 7. | <i>Ardeola grayii</i> | Pond Heron | LC |
| 8. | <i>Anthus rufulus</i> | Paddy field pipit | LC |
| 9. | <i>Columba livia</i> | Blue rock pigeon | IV |
| 10. | <i>Streptopeliachinensis</i> | Spotted Dove | LC |
| 11. | <i>Accipiter badius</i> | Shikra | LC |
| 12. | <i>Corvus macrorhynchos</i> | Jungle Crow | LC |
| 13. | <i>Corvus splendens</i> | House Crow | LC |
| 14. | <i>Turdoides caudatus</i> | Common babbler | LC |
| 15. | <i>Cuculus micropterus</i> | Indian cuckoo | LC |
| 16. | <i>Nectarinia minima</i> | Small Sunbird | LC |
| 17. | <i>Acridotherestrictis</i> | Common Myna | LC |
| 18. | <i>Centropus sinensis</i> | Southern Coucal | LC |
| 19. | <i>Dicrurus macrocercus</i> | Black Drongo | LC |
| 20. | <i>Cinnyris asiaticus</i> | Purple Sunbird | IV |
| 21. | <i>Apus affinis</i> | House swift | LC |
| 22. | <i>Passer domesticus</i> | House sparrow | LC |
| 23. | <i>Nycticorax nycticorax</i> | Night Heron | IV |



| | | | |
|-----|---------------------------|---------------------------|----|
| 24. | <i>Turdoides affinis</i> | White headed Babbler | LC |
| 25. | <i>Eudynamys</i> | Koel | LC |
| 26. | <i>Psittacula krameni</i> | Rose ringed parakeet | LC |
| 27. | <i>Corvus splendens</i> | House crow | LC |
| 28. | <i>Alcedo atthis</i> | Small blue kingfisher | LC |
| 29. | <i>Cuculus canorus</i> | Common Cuckoo | LC |
| 30. | <i>Pycnonotus cafer</i> | Red vented Bulbul | LC |
| 31. | <i>Milvus migrans</i> | Black kite | LC |
| 32. | <i>Meropsorientalis</i> | Small Bee-eater | LC |
| 33. | <i>Halcyon smyrnensis</i> | White-breasted Kingfisher | LC |

Reptiles

| SI. No | Scientific Name | Common Name | IUCN Red List data |
|--------|----------------------------------|------------------------|--------------------|
| 1. | <i>Mabuya carinatus</i> | Common skink | LC |
| 2. | <i>Calotes versicolor</i> | Oriental garden lizard | LC |
| 3. | <i>Ptyas mucosa</i> | Rat snake | NA |
| 4. | <i>Ahaetulla nasuta</i> | Green vine snake | LC |
| 5. | <i>Bungarus caeruleus</i> | Common krait | LC |
| 6. | <i>Nerodiapiscator</i> | Freshwater snake | NA |
| 7. | <i>Hemidactylus flaviviridis</i> | House lizards | NL |
| 8. | <i>Naja naja</i> | Indian cobra | LC |

Insects

| SI. No | Scientific Name | Common Name | IUCN Conservation Status |
|--------|---------------------------------|---------------------------|--------------------------|
| 1. | <i>Brachythemis contaminata</i> | Ditch jewe | LC |
| 2. | <i>Diplocodes trivialis</i> | Ground skimmer | LC |
| 3. | <i>Trithemis aurora</i> | Crimson marsh glider | LC |
| 4. | <i>Apis cerana</i> | Indian honey bee | |
| 5. | <i>Trithemis pallidinervis</i> | Long legged marsh skimmer | - |

Butterflies

| SI. No | Scientific Name | Common Name | IUCN Conservation Status |
|--------|------------------------------------|-----------------|--------------------------|
| 1. | <i>Junonialemonias</i> | Lemon Pansy | LC |
| 2. | <i>Danaus genutia</i> | Striped Tiger | LC |
| 3. | <i>Danaus chrysippuschrysippus</i> | Plain Tiger | LC |
| 4. | <i>Acraea terpsicore</i> | Tawny Coster | LC |
| 5. | <i>Jamidescelenocelena</i> | Common Cerulean | LC |
| 6. | <i>Papiliopolytesromulus</i> | Common Mormon | LC |
| 7. | <i>Papiliodemoleusdemoleus</i> | Lime Butterfly | LC |
| 8. | <i>Papiliopolytespolytes</i> | Common Mormon | LC |
| 9. | <i>Junoniahierta</i> | Yellow Pansy | LC |
| 10. | <i>Euchrysops snejus</i> | Gram Blue | LC |
| 11. | <i>Hypolimnasmisippus</i> | Danaid Eggfly | LC |
| 12. | <i>Phalantaphalantha</i> | Common Leopard | LC |



| | | | |
|-----|-------------------------|----------------------|----|
| 13. | Zizulahlax | Tiny Grass Blue | LC |
| 14. | Catochrysopsstrabo | Forget-Me-Not | LC |
| 15. | Lampidesboeticus | Pea Blue | LC |
| 16. | Euploea core | Common Crow | LC |
| 17. | Melanitisedaleda | Common Evening Brown | LC |
| 18. | Hypolimnasmisippus | DanaidEggfly | LC |
| 19. | Evereslacturnus | Indian Cupid | LC |
| 20. | Pachlioptaaristolochiae | Common Rose | LC |

Aquatic Ecology

Aquatic Flora Diversity

| S.No | Scientific name | Common Name | IUCN Red List of Threatened Species |
|------|-------------------------------|-------------------------|-------------------------------------|
| 1. | <i>Eichornia crassipe</i> | Water hyacinth | NA |
| 2. | <i>Aponogetonnatans</i> | Floating laceplant | NA |
| 3. | <i>Carex cruciata</i> | Cross Grass | NA |
| 4. | <i>Nymphaea nouchali</i> | Blue waterlily | LC |
| 5. | <i>Chrysopogon aciculatus</i> | Golden false beardgrass | NA |
| 6. | <i>Hydrilla verticillata</i> | Waterthymes | LC |
| 7. | <i>Cyperus exaltatus</i> | Tall Flat Sedge | LC |
| 8. | <i>Marsilea quadrifolia</i> | Water clover | LC |

Aquatic Faunal Diversity

Amphibians

| SI. No | Scientific Name | Common Name | IUCN Red List data |
|--------|-----------------------------------|--------------------|--------------------|
| 1. | <i>Duttaphrynus melanostictus</i> | Common Indian Toad | IV |
| 2. | <i>Rana tiger</i> | Common Frog | NA |
| 3. | <i>Euphlyctis hexadactylus</i> | Indian Pond Frog | LC |
| 4. | <i>Hoplobatrachus tigerinus</i> | Indian Bull Frog | IV/LC |

Fishes

| S.No | Common name | Scientific name | Family |
|------|------------------|----------------------------|---------------|
| 1. | Catla | <i>Catla Catla</i> | Cyprinidae |
| 2. | Dwarf panchax | <i>Aplocheilus parvus</i> | Aplocheilidae |
| 3. | Tank goby | <i>Glossogobius giuris</i> | Gobiidae |
| 4. | Ticto barb | <i>Pethia ticto</i> | Cyprinidae |
| 5. | Rohu | <i>Labeo rohita</i> | Cyprinidae |
| 6. | Catfish | <i>Siluriformes</i> | Diplomystidae |
| 7. | Mrigal | <i>Cirrhinus mrigala</i> | Chordata |
| 8. | Greenstripe barb | <i>Puntius vittatus</i> | Cyprininae |
| 9. | Pool barb | <i>Puntius sophore</i> | Cyprinidae |

Among the fauna recorded most of them are of common residence population and there are no endangered species in the study area.

Interpretation:

There is no schedule I species of animals observed within study area as per Wildlife Protection Act 1972 as well as no species is in vulnerable, endangered or threatened category as per IUCN. There is no endangered red list species found in the study area. Hence this small mining operation over short period of time will not have any significant impact on the surrounding flora and fauna.

3.7 SOCIO ECONOMIC ENVIRONMENT

To assess the impact on the socio economic environment, it is essential to collect the following data:

- * Population surrounding the project site those likely to be targeted receptor of impact
- * Employment pattern
- * Infrastructure facilities available to the local population such as water supply and sanitation electricity, roads, education and medical facilities.
- * Land use pattern.

Information on the Socio economic front has been collected from various secondary sources including 2011 published census data, Government and semi government office.

3.7.1 Objectives

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

- a) To study the socio-economic status of the people living in the study area of the project.
- b) To identify the basic needs of the nearby villages within the study area.
- c) To assess the impact on socio-economic environment due to the project.
- d) To provide the employment and improved living standards.
- e) To study the socio-economic status of the people living in the study area Sand quarry project region
- f) To assess the impact on socio-economic environment due to Sand quarry project region
- g) To analysis of impact of socio economic and Environmental Infrastructure facilities and road accessibility.

3.7.2 Methodology adopted for the study

The methodology adopted for the socio-economic impact assessment is as follows:

- a) The details of the activities and population structure have been obtained from Census 2001 and 2011 and analyzed.
- b) Based on the above data, impacts due to plant operation on the community have been assessed and recommendations for further improvement have been made.

3.6.5 Primary Survey

The primary data collection includes the collection of data through a structured interview schedule by direct observation method. The questionnaire survey includes both open and closed methods. The sample size is limited respondents, who were selected on the basis of simple random sampling from Virahalur Village, Lalgudi Taluk, Tiruchirappalli district, Tamil Nadu State in the field survey has been divided into three major segments namely Primary Zone (0 - 3 km), Secondary Zone (3 - 7 km) and tertiary Zone (7 - 10 km).

The questionnaires were designed to suit the subjects considering their rural background enabling to furnish correct information and data as far as possible. Data were collected at village level and household level by questionnaires and focused group discussions.

The study area for the field survey has been divided into three major segments namely Primary Zone (0 - 3 km), Secondary Zone (3 - 7 km) and Outer Zone (7 - 10 km).

3.10 Tiruchirappalli District

Tiruchirappalli District is located along the Kaveri River in Tamil Nadu, India. The main town in Tiruchirappalli District is the city of Tiruchirappalli, also known as Trichy. During the British Raj, Tiruchirappalli was known as Trichinopoly,

Tiruchirappalli district lies within Tamil Nadu. The district has an area of 4,404 square kilometers. It is bounded in the north by Salem district, in the northwest by Namakkal district, in the northeast by Perambalur district and Ariyalur district, in the east by Thanjavur District, in the southeast by Pudukkottai district, in the south by Madurai district and Sivagangai district, in the southwest by Dindigul district and, in the west by Karur district. The Kaveri River flows through the length of the district and is the principal source of irrigation and drinking water.

. Source: <https://tiruchirappalli.nic.in/about-district/>.

3.11 Study Area

Detailed socio-economic survey was conducted in the study area (Core and buffer zone) within 10 km radius of the area at Virahalur Village, Lalgudi Taluk, Tiruchirappalli district, Tamil Nadu State. In order to determine the impact of the proposed project on nature and inhabitant. To get an overview of the villagers and their perspectives about this proposed activity, different demographic parameters and social aspects such population density, sex ratio, literacy rate, worker ratio etc. has been identified, analyzed, studied together. These impacts may be beneficial or disadvantageous. If disadvantageous anticipated suggestions measures are advocated in order to have collective development.

3.12 Demographic pattern of 10km study area characteristics a comparative analysis

Table 3.25. Shows the socio-economic profile of the study area as compared to district, state and national level socio-economic profile

| Particular | India | Tamil Nadu | Tiruchirappalli District | Study Area (10km Radius) |
|------------------------------------|---------------|------------|--------------------------|--------------------------|
| Area (in sq. km.) | 3,287,263 | 130058 | 4,404 | 317 |
| Population Density/ sq. Km. | 368 | 554 | 618 | 424 |
| No. of Households | 249454252 | 13357027 | 698404 | 35660 |
| Population | 1210569573 | 72147030 | 2722290 | 134630 |
| Male | 623121843 | 36137975 | 1352284 | 65716 |
| Female | 587447730 | 36009055 | 1370006 | 68914 |
| Scheduled Tribes | 104281034 | 794697 | 18198 | 256 |
| Scheduled Castes | 201378086 | 14438445 | 466561 | 24156 |
| Literacy Rate | 72.99% | 80% | 75% | 82% |
| Sex Ratio (Females per 1000 Males) | 943 | 996 | 1013 | 1049 |

Source: Census of India, 2011.

District of Trichy area was 4404 sqkm and study area is about 315 sqkm. Population density is total population per sqkm. So, India population density was 368 sqkm, state of Tamil Nadu density was 554 sqkm, District had density about 618 sqkm and study area density is about 433 sqkm. As per Census 2011, about 5.96percent of population in the state lives in areas. Tiruchy had comparing state wise 4 percent of population lives in the district. In study area has 5 % around 10km radius. State, District and study area.

3.13 Population Projection of the Study Area

A population projection is an estimation of the number of people expected to be alive at a future date that is made based on assumptions of population structure, fertility, mortality and migration. It is an essential to assess the need for new jobs, schools, doctors and nurses, planning urban housing, foods, clothing and requirements of energy and resources. It is also needed for policy discourse i.e., helps to the policy-makers to understand the existing problems and finally supports to develop the suitable solutions

Table 3.26 Total Population of Study Area

| Sl No. | Population in 2001 | Population in 2011 |
|--------|--------------------|--------------------|
| 1 | 132075 | 134630 |

Source: <https://censusindia.gov.in/census.website/>

Table 3.27 Population Projection of Study Area

| S. No | Year | Projected Population (Approximately) |
|-------|------|--------------------------------------|
| 1. | 2021 | 137185 |
| 2. | 2031 | 139740 |
| 3. | 2041 | 142295 |
| 4. | 2051 | 144850 |

Source: Calculated by SPSS v23, 2022.

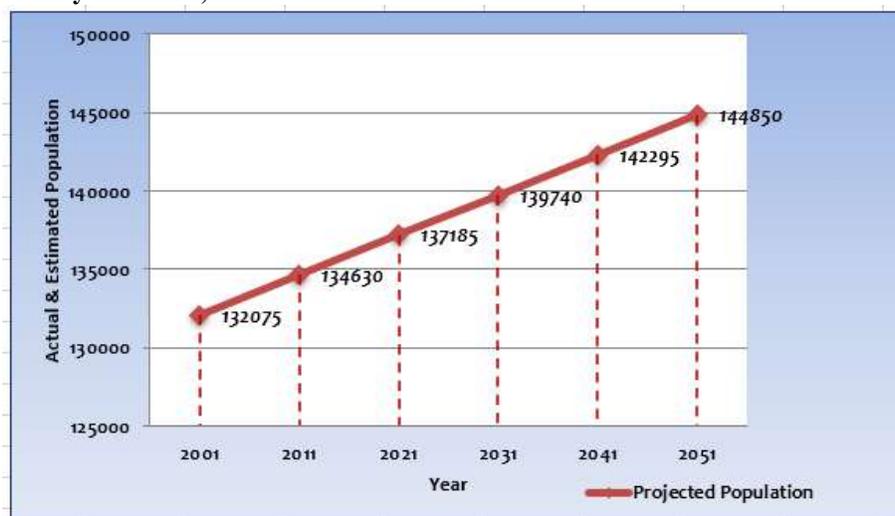


Fig 3.17 Graph Showing Population Projection

3.15 Population Distribution and Composition of Study Area

The population as per 2011 Census records is 134630 (for 10 km radius buffer zone). Total no. of household is 2383, 18054 and 15223 respectively, in primary, secondary and tertiary zone. Sex ratio is 1001, 1057 and 1046 (females per 1000 males) observed in primary, secondary and tertiary zone respectively. SC population distribution is 1598, 11432 and 11126 respectively in primary, secondary and tertiary zone. ST population distribution is 12, 81 and 163 respectively in primary, secondary and tertiary. Average household size is 4. Zone wise Demographic profile of study area is given in the table 3.15.1 below:

Source: <https://censusindia.gov.in/census.website/data/census-tables>

Table 3.28. Zone wise Demographic Profile of Study Area

| Zone | No. of Villages | Total Household | Total Population | Male Population | % | Female Population | % |
|-----------------------------|-----------------|-----------------|------------------|-----------------|--------------|-------------------|--------------|
| Primary Zone (0 - 3 Km) | 4 | 2383 | 8958 | 4476 | 49.97 | 4482 | 50.03 |
| Secondary Zone (3 - 7 Km) | 23 | 18054 | 68676 | 33382 | 48.61 | 35294 | 51.39 |
| Tertiary Zone (7 - 10 km) | 21 | 15223 | 56996 | 27858 | 48.88 | 29138 | 51.12 |
| Study Area (0-10 km) | 48 | 35660 | 134630 | 65716 | 48.81 | 68914 | 51.19 |

Source: Census of India, 2011

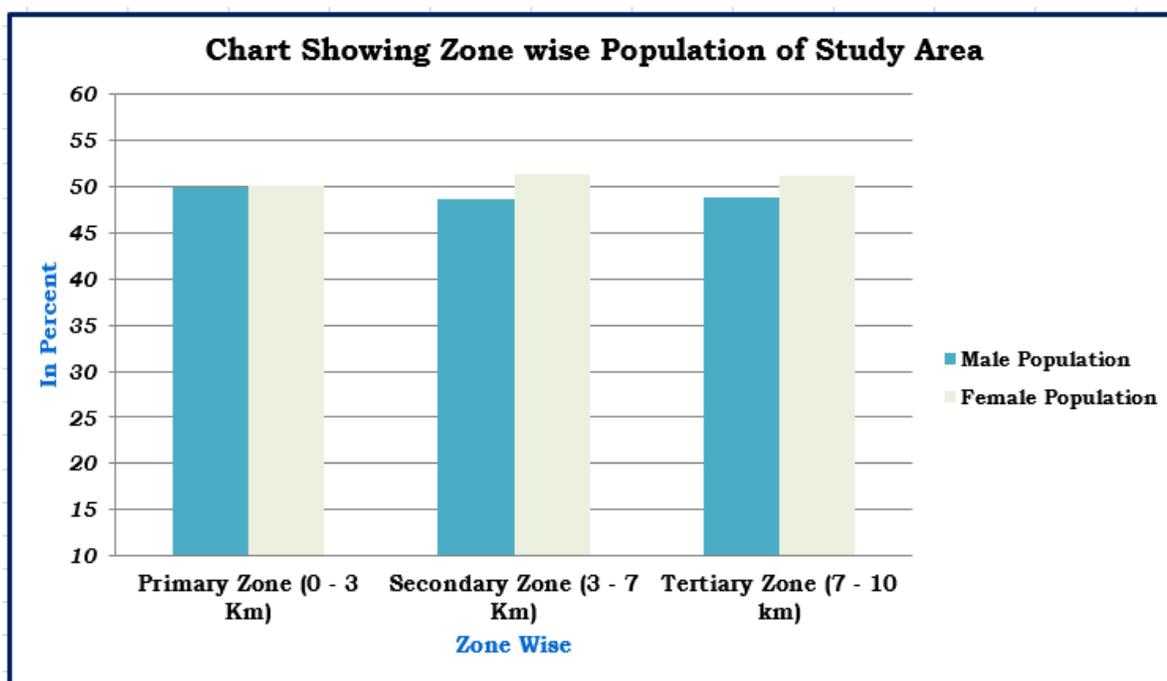


Figure 3.18 Population of study area

Table 3.29 : List of Villages, Demography details within the study area

| Sno | Name | Rural/Village/TP | No House Hold | Total Population | Male Population | Female Population | Person 0-6 yr | Male 0-6 | Female 0-6 | SC Population | SC Male | SC Female | ST Population | ST Male | ST Female | Literate Person | Male Literate | Female Literate | Total Workers | Main workers | Marginal workers | Non workers |
|---------------|---------------------------|------------------|---------------|------------------|-----------------|-------------------|---------------|-------------|-------------|---------------|-------------|-------------|---------------|-----------|-----------|-----------------|---------------|-----------------|---------------|--------------|------------------|--------------|
| 0-3km | | | | | | | | | | | | | | | | | | | | | | |
| 1 | Viragalur | Rural | 1163 | 4466 | 2285 | 2181 | 343 | 189 | 154 | 113 | 55 | 58 | 12 | 8 | 4 | 3601 | 1971 | 1630 | 1788 | 1314 | 474 | 2678 |
| 2 | Alambadi | Rural | 443 | 1452 | 686 | 766 | 146 | 72 | 74 | 434 | 204 | 230 | 0 | 0 | 0 | 948 | 524 | 424 | 779 | 753 | 26 | 673 |
| 3 | Vanarangudi | Rural | 418 | 1645 | 805 | 840 | 182 | 94 | 88 | 930 | 447 | 483 | 0 | 0 | 0 | 1178 | 609 | 569 | 676 | 666 | 10 | 969 |
| 4 | Vitalapuram | Rural | 359 | 1395 | 700 | 695 | 126 | 66 | 60 | 121 | 55 | 66 | 0 | 0 | 0 | 1099 | 585 | 514 | 641 | 575 | 66 | 754 |
| | Total | | 2383 | 8958 | 4476 | 4482 | 797 | 421 | 376 | 1598 | 761 | 837 | 12 | 8 | 4 | 6826 | 3689 | 3137 | 3884 | 3308 | 576 | 5074 |
| 3-7km | | | | | | | | | | | | | | | | | | | | | | |
| 1 | Kovandakurichi | Rural | 1614 | 6288 | 2813 | 3475 | 539 | 287 | 252 | 204 | 70 | 134 | 6 | 0 | 6 | 4899 | 2315 | 2584 | 2506 | 1825 | 681 | 3782 |
| 2 | Pudurpalayam | Rural | 758 | 2900 | 1433 | 1467 | 288 | 158 | 130 | 116 | 63 | 53 | 0 | 0 | 0 | 2074 | 1146 | 928 | 1370 | 1189 | 181 | 1530 |
| 3 | Alangudimahajanam | Rural | 369 | 1381 | 672 | 709 | 117 | 66 | 51 | 362 | 181 | 181 | 75 | 38 | 37 | 978 | 516 | 462 | 652 | 636 | 16 | 729 |
| 4 | T.Kallikudi | Rural | 680 | 2654 | 1315 | 1339 | 273 | 149 | 124 | 1165 | 568 | 597 | 0 | 0 | 0 | 2019 | 1059 | 960 | 1454 | 838 | 616 | 1200 |
| 5 | Nathamangudi | Rural | 561 | 2162 | 1093 | 1069 | 211 | 98 | 113 | 36 | 20 | 16 | 0 | 0 | 0 | 1639 | 916 | 723 | 1221 | 1059 | 162 | 941 |
| 6 | Palinganatham | Rural | 980 | 3538 | 1743 | 1795 | 331 | 174 | 157 | 198 | 92 | 106 | 0 | 0 | 0 | 2671 | 1449 | 1222 | 1433 | 541 | 892 | 2105 |
| 7 | Kovil Esanai (West) | Rural | 508 | 1711 | 793 | 918 | 210 | 97 | 113 | 165 | 73 | 92 | 0 | 0 | 0 | 1100 | 592 | 508 | 844 | 572 | 272 | 867 |
| 8 | Elandakudam | Rural | 1221 | 4559 | 2218 | 2341 | 420 | 220 | 200 | 663 | 330 | 333 | 0 | 0 | 0 | 3062 | 1694 | 1368 | 1911 | 1807 | 104 | 2648 |
| 9 | Kulamanickam (East) | Rural | 515 | 1846 | 871 | 975 | 138 | 65 | 73 | 64 | 32 | 32 | 0 | 0 | 0 | 1519 | 757 | 762 | 854 | 446 | 408 | 992 |
| 10 | Kulamanickam (West) | Rural | 1161 | 4074 | 1931 | 2143 | 361 | 184 | 177 | 446 | 210 | 236 | 0 | 0 | 0 | 2932 | 1505 | 1427 | 1799 | 1673 | 126 | 2275 |
| 11 | Kandiratheertham | Rural | 1017 | 3720 | 1770 | 1950 | 331 | 159 | 172 | 1120 | 529 | 591 | 0 | 0 | 0 | 2753 | 1446 | 1307 | 2064 | 1615 | 449 | 1656 |
| 12 | Achanur | Rural | 452 | 1629 | 812 | 817 | 173 | 84 | 89 | 415 | 202 | 213 | 0 | 0 | 0 | 1155 | 614 | 541 | 717 | 715 | 2 | 912 |
| 13 | Marur | Rural | 352 | 1368 | 690 | 678 | 158 | 78 | 80 | 620 | 305 | 315 | 0 | 0 | 0 | 1007 | 552 | 455 | 622 | 617 | 5 | 746 |
| 14 | Sathanur | Rural | 250 | 961 | 478 | 483 | 97 | 49 | 48 | 508 | 256 | 252 | 0 | 0 | 0 | 757 | 402 | 355 | 412 | 408 | 4 | 549 |
| 15 | Valappakudi | Rural | 617 | 2420 | 1217 | 1203 | 237 | 124 | 113 | 30 | 20 | 10 | 0 | 0 | 0 | 1722 | 951 | 771 | 1288 | 1280 | 8 | 1132 |
| 16 | Maharajapuram | Rural | 560 | 2145 | 1047 | 1098 | 196 | 97 | 99 | 896 | 426 | 470 | 0 | 0 | 0 | 1594 | 844 | 750 | 1012 | 991 | 21 | 1133 |
| 17 | Pavanamangalam | Rural | 304 | 1232 | 611 | 621 | 106 | 51 | 55 | 386 | 206 | 180 | 0 | 0 | 0 | 898 | 483 | 415 | 387 | 363 | 24 | 845 |
| 18 | Alamelapuram | Rural | 611 | 2519 | 1100 | 1419 | 203 | 109 | 94 | 368 | 134 | 234 | 0 | 0 | 0 | 2028 | 915 | 1113 | 980 | 927 | 53 | 1539 |
| 19 | Vishnampettai | Rural | 656 | 2655 | 1314 | 1341 | 296 | 139 | 157 | 654 | 328 | 326 | 0 | 0 | 0 | 1725 | 955 | 770 | 1136 | 1120 | 16 | 1519 |
| 20 | Tiruchinampoondi | Rural | 588 | 2147 | 1066 | 1081 | 192 | 97 | 95 | 836 | 424 | 412 | 0 | 0 | 0 | 1586 | 869 | 717 | 895 | 750 | 145 | 1252 |
| 21 | Mannarsamudram | Rural | 447 | 1795 | 905 | 890 | 205 | 109 | 96 | 120 | 61 | 59 | 0 | 0 | 0 | 1171 | 651 | 520 | 848 | 792 | 56 | 947 |
| 22 | Karuppur | Rural | 529 | 2000 | 988 | 1012 | 216 | 109 | 107 | 606 | 304 | 302 | 0 | 0 | 0 | 1422 | 769 | 653 | 870 | 548 | 322 | 1130 |
| 23 | Thirukkattupalli (TP) | Urban | 3304 | 12972 | 6502 | 6470 | 1285 | 615 | 670 | 1454 | 726 | 728 | 0 | 0 | 0 | 10004 | 5359 | 4645 | 4971 | 4385 | 586 | 8001 |
| | Total | | 18054 | 68676 | 33382 | 35294 | 6583 | 3318 | 3265 | 11432 | 5560 | 5872 | 81 | 38 | 43 | 50715 | 26759 | 23956 | 30246 | 25097 | 5149 | 38430 |
| 7-10km | | | | | | | | | | | | | | | | | | | | | | |
| 1 | Muthuvathur | Rural | 377 | 1426 | 704 | 722 | 155 | 86 | 69 | 149 | 82 | 67 | 16 | 6 | 10 | 828 | 477 | 351 | 816 | 149 | 667 | 610 |
| 2 | Venkatachalapuram (South) | Rural | 653 | 2230 | 1119 | 1111 | 186 | 112 | 74 | 80 | 38 | 42 | 1 | 1 | 0 | 1636 | 905 | 731 | 1237 | 1225 | 12 | 993 |
| 3 | Thinniyam | Rural | 576 | 2243 | 1121 | 1122 | 174 | 92 | 82 | 667 | 322 | 345 | 0 | 0 | 0 | 1958 | 994 | 964 | 1293 | 1172 | 121 | 950 |
| 4 | Keelanbil | Rural | 464 | 1692 | 814 | 878 | 159 | 78 | 81 | 765 | 371 | 394 | 0 | 0 | 0 | 1293 | 677 | 616 | 968 | 683 | 285 | 724 |
| 5 | Kallakudi (TP) | Urban | 3178 | 11604 | 5661 | 5943 | 1120 | 566 | 554 | 1222 | 610 | 612 | 3 | 2 | 1 | 9277 | 4804 | 4473 | 4256 | 3218 | 1038 | 7348 |

| | | | | | | | | | | | | | | | | | | | | | | |
|----|------------------|-------|--------------|---------------|--------------|--------------|--------------|-------------|-------------|--------------|--------------|--------------|------------|------------|------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| 6 | Pullampadi (TP) | Urban | 2628 | 10241 | 4868 | 5373 | 977 | 486 | 491 | 555 | 258 | 297 | 63 | 29 | 34 | 7838 | 3990 | 3848 | 4440 | 3567 | 873 | 5801 |
| 7 | Karaiyavetti | Rural | 793 | 3051 | 1517 | 1534 | 327 | 171 | 156 | 161 | 82 | 79 | 0 | 0 | 0 | 1931 | 1100 | 831 | 1744 | 1739 | 5 | 1307 |
| 8 | Venganur | Rural | 667 | 2409 | 1168 | 1241 | 291 | 152 | 139 | 214 | 100 | 114 | 0 | 0 | 0 | 1396 | 768 | 628 | 1326 | 911 | 415 | 1083 |
| 9 | Sannavur (North) | Rural | 477 | 1520 | 734 | 786 | 169 | 98 | 71 | 313 | 142 | 171 | 0 | 0 | 0 | 770 | 432 | 338 | 951 | 767 | 184 | 569 |
| 10 | Sannavur (South) | Rural | 544 | 1920 | 956 | 964 | 244 | 137 | 107 | 525 | 251 | 274 | 80 | 41 | 39 | 1242 | 676 | 566 | 1121 | 249 | 872 | 799 |
| 11 | Thirumazhapadi | Rural | 773 | 2849 | 1387 | 1462 | 258 | 140 | 118 | 830 | 405 | 425 | 0 | 0 | 0 | 2176 | 1114 | 1062 | 1335 | 1330 | 5 | 1514 |
| 12 | Annimangalam | Rural | 893 | 3262 | 1600 | 1662 | 349 | 193 | 156 | 1462 | 708 | 754 | 0 | 0 | 0 | 2213 | 1195 | 1018 | 1723 | 1373 | 350 | 1539 |
| 13 | Kaduveli | Rural | 467 | 2077 | 1031 | 1046 | 186 | 96 | 90 | 743 | 368 | 375 | 0 | 0 | 0 | 1507 | 801 | 706 | 946 | 927 | 19 | 1131 |
| 14 | Vadugakudi | Rural | 186 | 696 | 353 | 343 | 48 | 31 | 17 | 74 | 33 | 41 | 0 | 0 | 0 | 573 | 305 | 268 | 261 | 258 | 3 | 435 |
| 15 | Rajagiri | Rural | 600 | 2247 | 1107 | 1140 | 188 | 97 | 91 | 947 | 459 | 488 | 0 | 0 | 0 | 1829 | 952 | 877 | 966 | 501 | 465 | 1281 |
| 16 | Tiruvalampozhil | Rural | 432 | 1747 | 848 | 899 | 160 | 68 | 92 | 508 | 238 | 270 | 0 | 0 | 0 | 1252 | 674 | 578 | 882 | 874 | 8 | 865 |
| 17 | Varagur | Rural | 719 | 2833 | 1402 | 1431 | 303 | 162 | 141 | 964 | 479 | 485 | 0 | 0 | 0 | 2134 | 1123 | 1011 | 1201 | 442 | 759 | 1632 |
| 18 | Unjini | Rural | 47 | 176 | 89 | 87 | 11 | 8 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 148 | 74 | 74 | 69 | 66 | 3 | 107 |
| 19 | Adanjur | Rural | 162 | 625 | 306 | 319 | 72 | 33 | 39 | 156 | 76 | 80 | 0 | 0 | 0 | 471 | 250 | 221 | 290 | 255 | 35 | 335 |
| 20 | Ammayagaram | Rural | 309 | 1110 | 569 | 541 | 93 | 51 | 42 | 577 | 300 | 277 | 0 | 0 | 0 | 926 | 497 | 429 | 521 | 40 | 481 | 589 |
| 21 | Kalumangalam | Rural | 278 | 1038 | 504 | 534 | 85 | 42 | 43 | 214 | 103 | 111 | 0 | 0 | 0 | 651 | 347 | 304 | 381 | 352 | 29 | 657 |
| | Total | | 15223 | 56996 | 27858 | 29138 | 5555 | 2899 | 2656 | 11126 | 5425 | 5701 | 163 | 79 | 84 | 42049 | 22155 | 19894 | 26727 | 20098 | 6629 | 30269 |
| | G.Total | | 35660 | 134630 | 65716 | 68914 | 12935 | 6638 | 6297 | 24156 | 11746 | 12410 | 256 | 125 | 131 | 99590 | 52603 | 46987 | 60857 | 48503 | 12354 | 73773 |

Source : Village Wise Demographic Profile of the Study Area, Census of India, 2011

Literacy Rate in Study Area

Literacy Rate is the percentage of people in a country with the ability to read and write. The analysis of the literacy levels is done in the study area. The 10 km radius of study area demonstrates a literacy rate of 82% as per census data 2011. The male literacy rate in the study area indicates 89% whereas the female literacy rate, which is an important indicator for social change, is observed to be 75% as per the census data 2011. This needs to focus on the region and enhance further development focusing on education. (Table no 3.17.1).

Table 3.30. Literacy Rate of the Study Area

| Zone | No. of Villages | Male Literacy Population | Male literacy Rate | Female Literacy Population | Female literacy Rate | Total Literacy | Total Literacy Rate |
|----------------------------|-----------------|--------------------------|--------------------|----------------------------|----------------------|----------------|---------------------|
| Primary Zone (0 - 3 Km) | 4 | 3689 | 90.97 | 3137 | 76.40 | 6826 | 83.64 |
| Secondary Zone (3 - 7 Km) | 23 | 26759 | 89.01 | 23956 | 74.79 | 50715 | 81.68 |
| Tertiary Zone (7 - 10 Km) | 21 | 22155 | 88.77 | 19894 | 75.12 | 42049 | 81.74 |
| Study Area (0-10km) | 48 | 52603 | 89.04 | 46987 | 75.04 | 99590 | 81.84 |

Source: Census of India, 2011

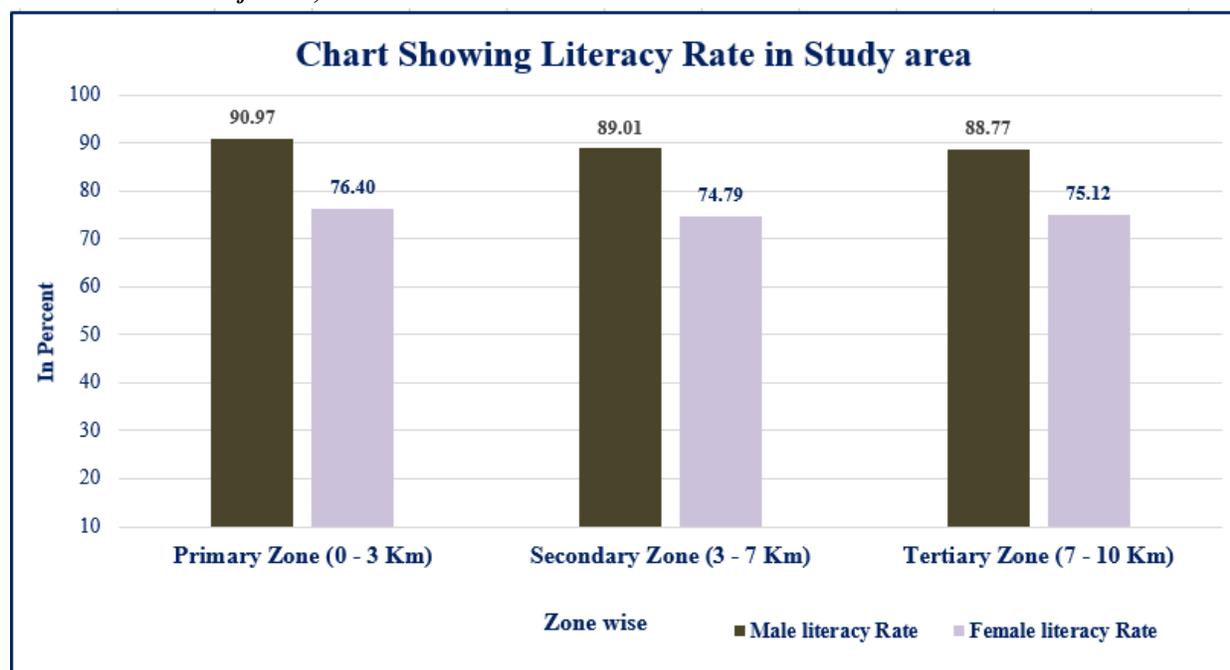


Figure 3.19 Gender wise Literacy Rate in the study area

3.18 Family Size

Size of family also describes about family functioning, resource consumption, total income generated and their expenditure pattern. Census 2011 data suggests that most of these households have a family size of up to 4 members, knowing the size of family also give fair understanding of relating how much resource consumption is being incurred, and annual income being generated and spent.

3.19 Vulnerable Group

While developing an action plan, it is very important to identify the population who fall under the marginalized and vulnerable groups and special attention has to be given towards these groups while making action plans. Special provisions should be made for them. In the observed villages schedule caste (SC) population is 23.4% and Schedule Tribe population 0.19%, Other Population is 76 % in total study area.

Table 3.31 vulnerable groups of the study area

| Zone | No. of Villages | Vulnerable Groups | | | | | |
|---------------------------|-----------------|-------------------|--------------|---------------|-------------|------------------|--------------|
| | | SC Population | % | ST Population | % | Other Population | % |
| Primary Zone (0 - 3 Km) | 4 | 1598 | 17.84 | 12 | 0.13 | 7348 | 82.03 |
| Secondary Zone (3 - 7 Km) | 23 | 11432 | 16.65 | 81 | 0.12 | 57163 | 83.24 |
| Tertiary Zone (7 - 10 Km) | 21 | 11126 | 19.52 | 163 | 0.29 | 45707 | 80.19 |
| Total area (10km) | 48 | 24156 | 17.94 | 256 | 0.19 | 110218 | 81.87 |

Source: Census of India, 2011

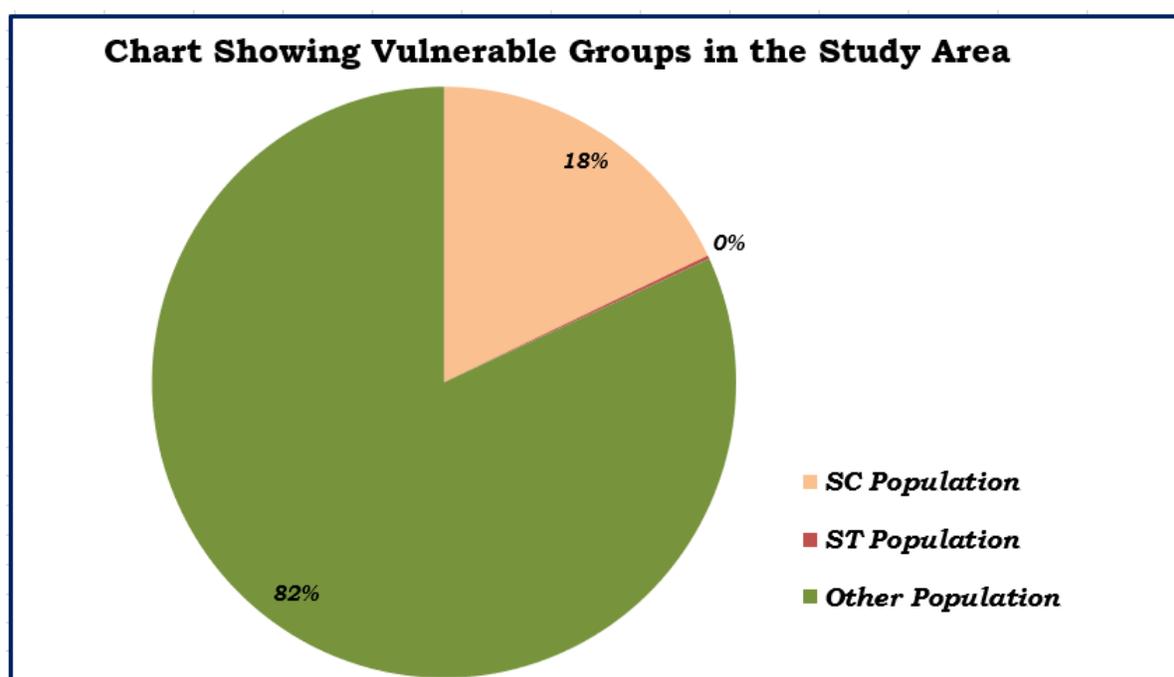


Figure 3.20 vulnerable groups

3.20 Economic Activities

The economy of an area is defined by the occupational pattern and income level of the people in the area. The occupational structure of residents in the study area is studied with reference to work category. The population is divided occupation wise into three categories, viz., Total workers, Main workers and non-workers. The main workers include cultivators, agricultural laborers, those engaged in household industry and other services. The non-workers include those engaged in unpaid household duties like, students, retired persons, dependents, beggars, vagrants etc. besides Institutional intimates or all other non-workers who do not fall under the above categories.

Table 3.32 shows the work force of the study area

| Zone | No. of Villages | Total Workers | % | Main Workers | % | Marginal Workers | % | Non-Workers | % |
|---------------------------|-----------------|---------------|--------------|--------------|--------------|------------------|-------------|--------------|--------------|
| Primary Zone (0 - 3 Km) | 4 | 3884 | 43.36 | 3308 | 36.93 | 576 | 6.43 | 5074 | 56.64 |
| Secondary Zone (3 - 7 Km) | 23 | 30246 | 44.04 | 25097 | 36.54 | 5149 | 7.50 | 38430 | 55.96 |
| Tertiary Zone (7 - 10 Km) | 21 | 26727 | 46.89 | 20098 | 35.26 | 6629 | 11.63 | 29612 | 51.95 |
| Study Area (10 Km) | 48 | 60857 | 45.20 | 48503 | 36.03 | 12354 | 9.18 | 73116 | 54.31 |

Source: Census of India, 2011

The above table shows that out of the total working population, the percentage of main workers is 36 % while 9% are marginal workers. Number of working populations is 45.2% and non-working population is 54.3 % in the study area. As per the data obtained from the survey (as mentioned previously in occupational structure) most of these people are employed for major period of the year. Also, to mention the natural environment also restricts the people in finding stable business is performed for only certain months. Thus, proposed project will act as possible exposure for them to get enrol and earn sustain livelihood.



Figure 3.21 Working population in the study area

3.21 Infrastructure Base

A better network of physical infrastructure facilities (built up and roads, irrigation, power and social infrastructure support, viz. health and Education, water and sanitation are essential for the development of the rural economy.

A review of infrastructural facilities available in the area has been done based on the information from baseline survey & census data of the study area. Infrastructural facilities available in the area are described in the subsequent sections.

- **Administrative offices** are located in Tamil Nadu, Trichy district (35km-SW) from site which by local transport and Sub collector office, Lalgudi Taluk (8km-SW).
- **Kollidam River** side around 10 km from mine lease boundary. belongs to Cauvery River near (3km-S), Kollidam river a centre of the sand mine area.
- **Availability of Government Higher Secondary school** Anbil Village (NE-1.5km), Government ADW Primary school, Keelanbil village, Government middle school, Alambakkam Village (3km-NW) Government Higher Secondary school, Ariyalur (6.5km-NW), Govt School, Thirukattupalli (6km-SW), Government school, Alur Village (SE-9km), and Trichy, Ariyalur and Thanjavur Taluk many colleges and Training institute found in study area.
- **Health facilities** covered in the Buffer zone area like Government Hospital, Karuppur Village (SE-4.5km), Government Hospital, Konerirajapuram Village (SE-5km) Government Hospital, Senthalai (5km-SE), Government Hospital, Thirukattupalli Town Panchayat (6km-SW), Government Hospital, Venkatachalapuram (7km-NW), PHC, Pullambadi (9.0km-NW) Trichy, Ariyalur and Thanjavur district in number of clinics and medical centre and Government Hospital, etc.

3.23 Interpretation

Based on the data, following inferences could be drawn:

- Total literacy rate in the study area is 82%.
- The study area had good educational facilities. The overall status depicts that the education is limited to primary and middle level.
- The schedule tribe community forms 0.19% and Scheduled Caste forms 18% of the total population of study area.
- The Other Population forms 82% of the total population of study area.
- The study area is well connected by District/Village Road.
- The study area not well health facilities of primary level.
- Considering the above facts, the proposed project will boost the socio-economic development activities in the area and hence will leave positive impact.
- The core area not good mobile connectivity. Buffer area is well connectivity.

3.24 Recommendation and Suggestions

The village development plans are made in consultation with the community through Gram Sabha; these appear to address the needs of the community. However, it may be noted that at the implementation stage these plans often are fraught with problem of inadequate funds, lack of proper planning, corruption, vested interests and political agendas. Hence while ascertaining the scope for convergence with the government activities, care must be taken to ascertain realistic possibilities for implementation.

- **Women empowerment**– Home based income generation activities, vocational training programs and common education centre for increasing the literacy rate.
- **Education** – Free uniform, construction of common rooms and library, computer education and physical education, additional schools for girls, furniture and equipment in schools, up-gradation of existing school infrastructure.
- **Agriculture/livestock** – Infrastructure such as agricultural practices, electricity connections, assistance with buying improved tools and equipment, capacity building, supply and/or knowledge of better variety of seeds, pasture land development and trainings on animal husbandry & facility of veterinary doctor.
- **Health** – Improvements in sanitary conditions of villages, assistance with construction of latrines, improvement in drainage system, health camps and awareness campaigns for diseases like Covid-19, malaria, typhoid, tuberculosis, yellow fever and pneumonia. Repairing of PHCs and Anganwadi centers.
- **People with disability** – Establishment of center for special education, sensitization of the community towards disabled and awareness on Government schemes.

- 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.

Connectivity –Road network and transport connectivity to easiness accessibility to the region

3.25 Conclusion

To evaluate the impacts of proposed Sand quarry project on the surrounding area, it is vital to assess the baseline status of the environmental quality in the locality of the site. Hence it can be concluded that the present environment status of the study area will not be affected by the project as The Executive Engineer, WRD, MMD, Tiruchirappalli, will adopt adequate control measures to protect the surrounding environment and will contribute in development of the study areas.

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.

Conclusion SIA has traditionally involved the use of technical and participatory analytical methods to anticipate change but also encouraging the life cycle of projects to minimize negative outcomes and maximize benefits. The early consideration of social impacts, the alignment of activities with regional and community planning objectives, and meaningful participation of community in decision making are key features. Apart from the SIA process and findings it can be concluded that most the respondents have positive pulse towards implementation of the proposed project.

3.8 SUMMARY OF THE BASELINE STATUS:

The interpretations of the baseline environmental status in the study area are following.

- * The monitored Air quality in the project area was found to be in compliance with the NAAQ norms for industrial and residential rural and other areas.
- * The noise level Leq during the day and night was found to be well within the ambient noise quality standards notified under Environmental (Protection) Act 1986.
- * The quality of the surface water and ground water are found well within the prescribed standards of CGWB Norms and drinking water specification IS 10500 and Central Pollution Control Board water quality criteria.
- * There is no eco sensitive zone or any Archeological/ historical places found within the vicinity of the project area.
- * There are no endangered red list species of fauna and the area is thinly populated. All basic facilities like school, hospitals, communication center, transportation center, are available in and around the project area.
- * There is sufficient buffer zone for the project with respect to physical and biological environments. There is no effluent discharge from the mine to the nearby water.

CHAPTER – 4: ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

4.0 INTRODUCTION: -

The environmental impact can be categorized as either primary or secondary, primary impacts which are attributed directly by the project; secondary impacts are those which are indirectly induced. This particular open cast mining operations involve Excavation of Sand, Approach road, Haul road and handling of material. No drilling and blasting involved in this type of sand mining operation.

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 for sustainable resource extraction. Based on the baseline environmental status at the existing mine site, the environmental factors that are likely to be affected (Impacts) are identified, quantified and assessed. The various anticipated impacts will be on

The various anticipated impacts will be in

- * Land environment
- * Soil environment
- * Water Environment
- * Air Environment
- * Noise Environment
- * Socio economic environment
- * Solid waste

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

4.1 LAND ENVIRONMENT

4.1.2 Anticipated Impact

The total project area is 24.00.0 ha is proposed for quarrying activity (Excavation). The proposed area is Coleroon River land. The mining activity is proposed to a maximum depth of 3.2m (2.2m abl + 1.0m bbl).

Due to mining operation, there is no remarkable impact on environment, except land degradation within project area. No release of toxic elements into the ground. No adverse impact is anticipated on land use of buffer zone associated due to the mining activity, as all the activities will be confined within the project area. The quarrying operations will impact the land usage and land aesthetics of project area. The land degradation is unavoidable during quarry activities like excavation, mineral handling etc.,

4.1.3 Mitigation measures

Due to the mining operation the land will get positive impact, the main aim of the mining operation is to restore the functional efficiency of the river.

4.1.4 Soil Environment

4.1.4.1 Impact on Soil Environment

- * Mining in the riverbed may change complete land use pattern including channel geometry, bed elevation, sediment transportation capacity which can reduce flow of the river and downstream erosion.
- * Mining activity may increase the soil erosion and soil degradation which have adverse impact on soil fertility.

4.1.4.2 Mitigation measures for Soil Conservation

- * The mining is planned in non monsoon seasons only so that the excavated area will be replenished naturally during the subsequent rainy season for the river bed mining block.

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 quarrying activity will not intersect ground water table as the maximum depth of the quarry is 3.2m (2.2m abl + 1.0m bbl) and the water table in the area is 12m bgl.

Table 4.1: Water Requirements

| *Purpose | Quantity | Source |
|-------------------------------|----------------|---|
| Dust Suppression | 1.0 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 | 1.0 KLD | Water Tankers |
| Total | 3.0 KLD | |

* Water for drinking purpose will be brought from approved water vendors

Source: Approved Mining Plan Pre-Feasibility Report

Total water requirement in the proposed project is about 3.0 KLD, the water for dust suppression and greenbelt development will be sourced from the stagnant water in the river, the water for domestic purpose and drinking will be sourced from the approved water vendors.

4.2.2 Mitigation measures

The quarrying operation is restricted well above the water table. The water table will not be intersected during mining in the riverbed. There is no proposal of any stream modification/diversion due to this mining activity hence there will be no any impact on flow of the river.

4.3 AIR ENVIRONMENT

Quarrying Operations will be to carried out by opencast method without involving drilling and blasting, dust particles are generated only due to Excavation, Loading, handling of mineral and transportation. The air quality in the study area depends upon the nature and concentration of emissions and meteorological conditions. Prediction of impacts on air environment has been carried out taking into consideration proposed production of 7,68,000m³ of sand on air environment and net increase in emissions by Open pit source modeling in AERMOD Software.

The air borne particulate matter is the main air pollutant in this opencast mining. The mining operation will be carried out using Hydraulic Excavators for the excavation of Sand.

The major air pollutants due to mining activity includes:-

- * Particulate Matter (Dust) of various sizes.
- * Gases, such as, Sulphur Dioxide, Oxides of Nitrogen, Carbon Monoxide etc., from vehicular exhaust.
- * Dust is the single air pollutant observed in the open cast mines. Diesel operating vehicles produce NO_x, SO₂ and CO emissions, usually at low levels. Dust can be of significant nuisance surrounding land users and potential health risk in some circumstances.

Meteorological Data –

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 and monitored continually for study period without break. The station was installed at a height of 4 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. A weather data was collected from IMD, Tiruchirappalli for the month of December 2022 to February 2023 to correlate with site data and found not much of change in the parameters.

Figure 4.1: AERMOD Terrain Map

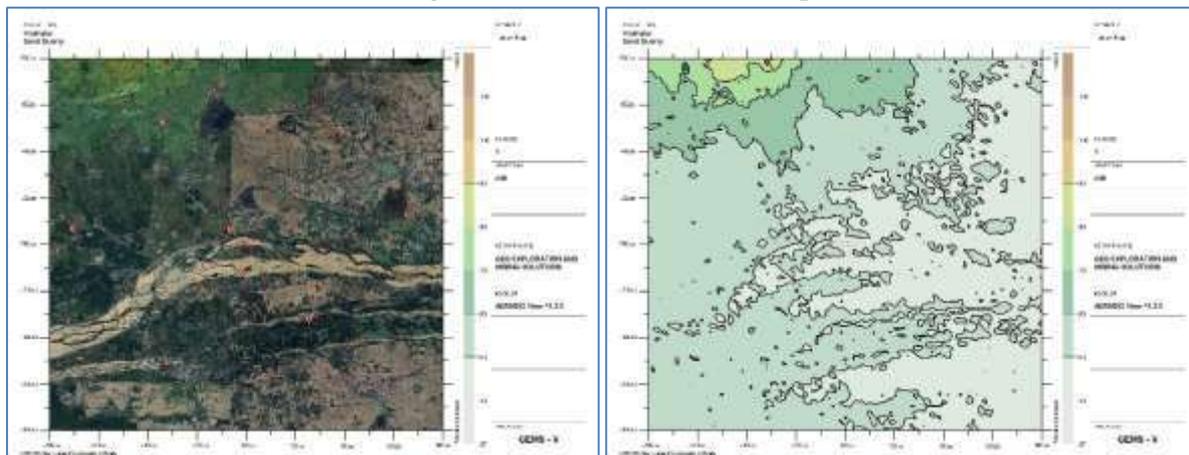


Figure 4.2: Predicted Incremental Concentration of PM₁₀

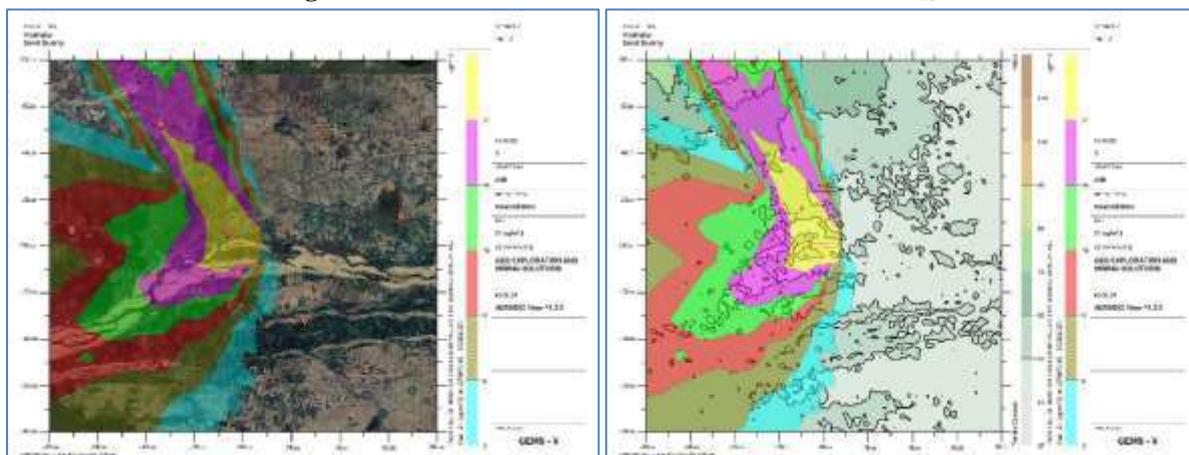


Figure 4.3: Predicted Incremental Concentration of PM_{2.5}

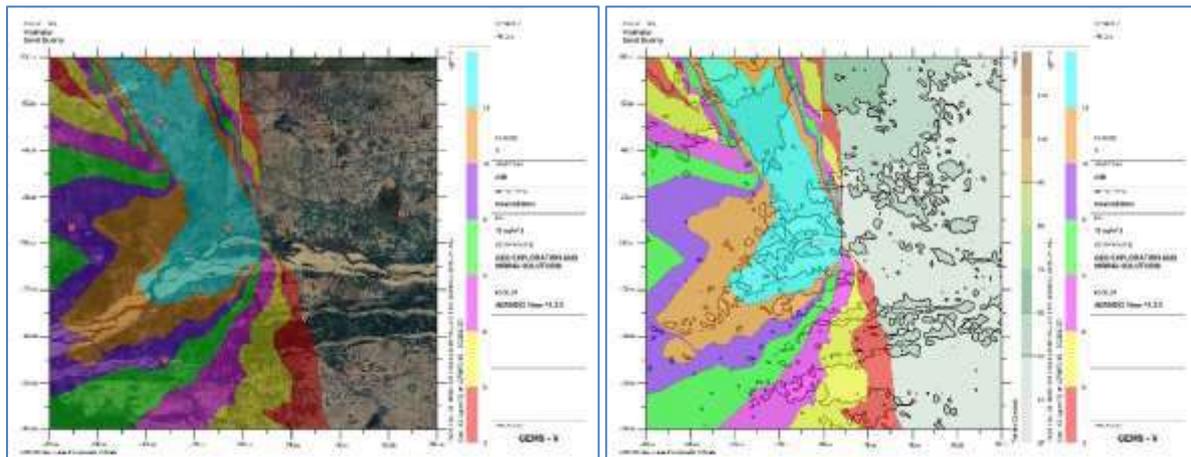


Figure 4.4: Predicted Incremental Concentration of SO₂

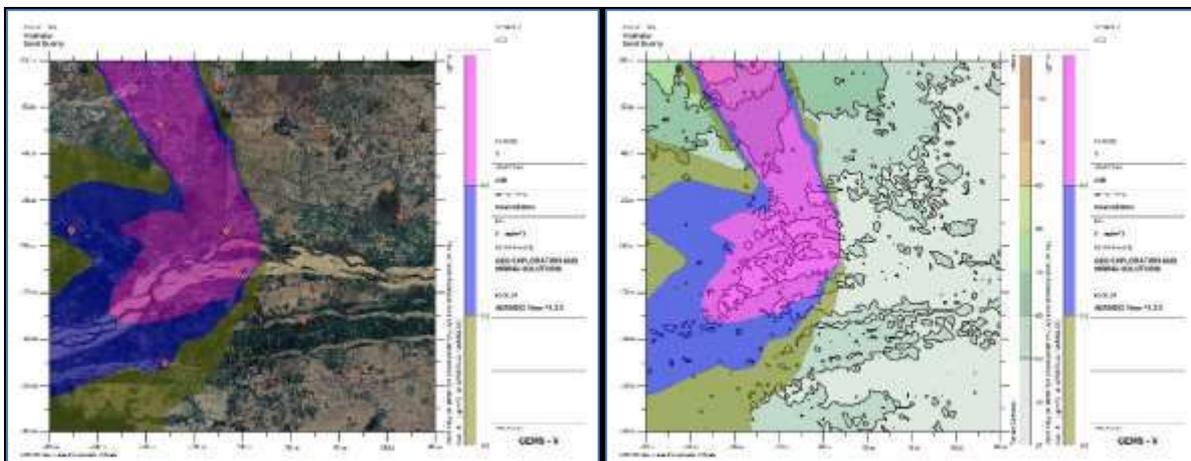


Figure 4.5: Predicted Incremental Concentration of NO_x

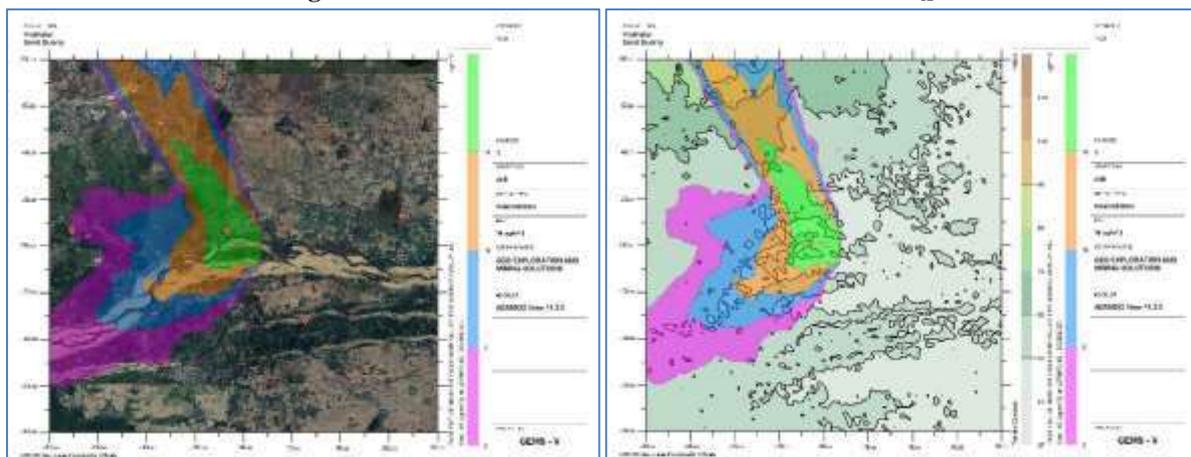
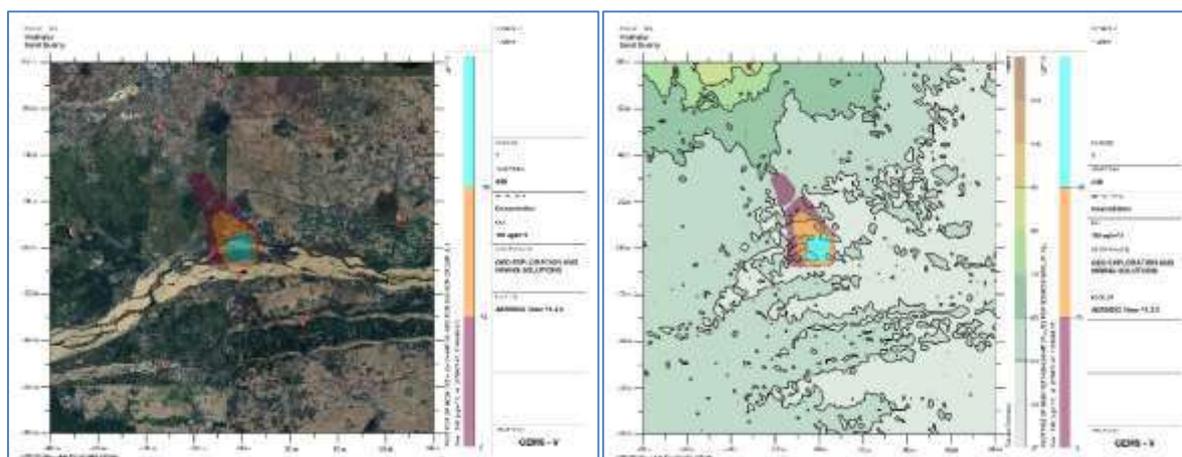


Figure 4.6: Predicted Incremental Concentration of Fugitive Dust

4.3.2.1 Model Results

The post project Resultant Concentrations of PM₁₀, PM_{2.5}, SO₂ & NO_x (GLC) is given in Table below:

Table 4.2: Incremental & Resultant GLC of PM₁₀

| Station Code | Location | X Coordinate (m) | Y Coordinate (m) | Average Baseline PM ₁₀ (µg/m ³) | Incremental value of PM ₁₀ due to mining (µg/m ³) | Total PM ₁₀ (µg/m ³) (5+6) |
|--------------|--------------------------------|------------------|------------------|--|--|---|
| AAQ1 | 10°54'7.12"N 78°58'19.76"E | -653 | 319 | 43.1 | 21.68 | 64.78 |
| AAQ2 | 10°53'7.81"N 78°58'36.25"E | -153 | -1508 | 43.6 | 14.74 | 58.34 |
| AAQ3 | 10°54'27.58"N 79° 2'16.11"E | 6557 | 946 | 43.3 | 0 | 43.3 |
| AAQ4 | 10°54'8.15"N 78°54'49.42"E | -7079 | 354 | 43.3 | 11.00 | 54.3 |
| AAQ5 | 10°51'2.82"N 78°56'56.29"E | -3202 | -5352 | 43.9 | 7.15 | 51.05 |
| AAQ6 | 10°52'2.04"N 79° 0'4.62"E | 2545 | -3534 | 43.3 | 0 | 43.3 |
| AAQ7 | 10°56'36.68"N 78°56'50.09"E | -3394 | 4923 | 43.0 | 20.50 | 63.5 |
| AAQ8 | 10°57'29.63"N 78°58'7.87"E | -1019 | 6555 | 43.3 | 2.00 | 45.3 |

Table 4.3: Incremental & Resultant GLC of PM_{2.5}

| Station Code | Location | X Coordinate (m) | Y Coordinate (m) | Average Baseline PM _{2.5} (µg/m ³) | Incremental value of PM _{2.5} due to mining (µg/m ³) | Total PM _{2.5} (µg/m ³) (5+6) |
|--------------|--------------------------------|------------------|------------------|---|---|--|
| AAQ1 | 10°54'7.12"N 78°58'19.76"E | -653 | 319 | 23.8 | 13.80 | 37.6 |
| AAQ2 | 10°53'7.81"N 78°58'36.25"E | -153 | -1508 | 23.2 | 12.00 | 35.2 |
| AAQ3 | 10°54'27.58"N 79° 2'16.11"E | 6557 | 946 | 23.7 | 0 | 23.7 |
| AAQ4 | 10°54'8.15"N 78°54'49.42"E | -7079 | 354 | 21.8 | 8.91 | 30.71 |
| AAQ5 | 10°51'2.82"N 78°56'56.29"E | -3202 | -5352 | 23.2 | 7.30 | 30.5 |
| AAQ6 | 10°52'2.04"N 79° 0'4.62"E | 2545 | -3534 | 23.6 | 0.80 | 24.4 |
| AAQ7 | 10°56'36.68"N 78°56'50.09"E | -3394 | 4923 | 21.6 | 13.18 | 34.78 |
| AAQ8 | 10°57'29.63"N 78°58'7.87"E | -1019 | 6555 | 23.7 | 5.00 | 28.7 |

Table 4.4: Incremental & Resultant GLC of SO₂

| Station Code | Location | X Coordinate (m) | Y Coordinate (m) | Average Baseline SO ₂ (µg/m ³) | Incremental value of SO ₂ due to mining (µg/m ³) | Total SO ₂ (µg/m ³) (5+6) |
|--------------|--------------------------------|------------------|------------------|---|---|--|
| AAQ1 | 10°54'7.12"N 78°58'19.76"E | -653 | 319 | 8.0 | 5.48 | 13.48 |
| AAQ2 | 10°53'7.81"N 78°58'36.25"E | -153 | -1508 | 6.8 | 5.00 | 11.8 |
| AAQ3 | 10°54'27.58"N 79° 2'16.11"E | 6557 | 946 | 6.9 | 0 | 6.9 |
| AAQ4 | 10°54'8.15"N 78°54'49.42"E | -7079 | 354 | 6.9 | 3.69 | 10.59 |
| AAQ5 | 10°51'2.82"N 78°56'56.29"E | -3202 | -5352 | 6.5 | 2.18 | 8.68 |
| AAQ6 | 10°52'2.04"N 79° 0'4.62"E | 2545 | -3534 | 6.9 | 0 | 6.9 |
| AAQ7 | 10°56'36.68"N 78°56'50.09"E | -3394 | 4923 | 7.0 | 5.21 | 12.21 |
| AAQ8 | 10°57'29.63"N 78°58'7.87"E | -1019 | 6555 | 6.9 | 0 | 6.9 |

Table 4.5: Incremental & Resultant GLC of NO_x

| Station | Location | X | Y | Average | Incremental | Total |
|---------|----------|---|---|---------|-------------|-------|
|---------|----------|---|---|---------|-------------|-------|

| Code | | Coordinate (m) | Coordinate (m) | Baseline Nox ($\mu\text{g}/\text{m}^3$) | value of Nox due to mining ($\mu\text{g}/\text{m}^3$) | Nox ($\mu\text{g}/\text{m}^3$) (5+6) |
|------|--------------------------------|----------------|----------------|---|---|--|
| AAQ1 | 10°54'7.12"N 78°58'19.76"E | -653 | 319 | 25.4 | 16.30 | 41.7 |
| AAQ2 | 10°53'7.81"N 78°58'36.25"E | -153 | -1508 | 23.7 | 8.10 | 31.8 |
| AAQ3 | 10°54'27.58"N 79° 2'16.11"E | 6557 | 946 | 23.4 | 0 | 23.4 |
| AAQ4 | 10°54'8.15"N 78°54'49.42"E | -7079 | 354 | 22.6 | 1.00 | 23.6 |
| AAQ5 | 10°51'2.82"N 78°56'56.29"E | -3202 | -5352 | 23.1 | 0 | 23.1 |
| AAQ6 | 10°52'2.04"N 79° 0'4.62"E | 2545 | -3534 | 23.4 | 0 | 23.4 |
| AAQ7 | 10°56'36.68"N 78°56'50.09"E | -3394 | 4923 | 23.5 | 14.48 | 37.98 |
| AAQ8 | 10°57'29.63"N 78°58'7.87"E | -1019 | 6555 | 23.4 | 0 | 23.4 |

Table 4.6: Incremental & Resultant GLC of Fugitive dust

| Station Code | Location | X Coordinate (m) | Y Coordinate (m) | Average Baseline Fugitive ($\mu\text{g}/\text{m}^3$) | Incremental value of Fugitive due to mining ($\mu\text{g}/\text{m}^3$) | Total Fugitive ($\mu\text{g}/\text{m}^3$) (5+6) |
|--------------|--------------------------------|------------------|------------------|--|--|---|
| AAQ1 | 10°54'7.12"N 78°58'19.76"E | -653 | 319 | 68.1 | 150 | 218.1 |
| AAQ2 | 10°53'7.81"N 78°58'36.25"E | -153 | -1508 | 73.4 | 0 | 73.4 |
| AAQ3 | 10°54'27.58"N 79° 2'16.11"E | 6557 | 946 | 68.3 | 0 | 68.3 |
| AAQ4 | 10°54'8.15"N 78°54'49.42"E | -7079 | 354 | 63.7 | 0 | 63.7 |
| AAQ5 | 10°51'2.82"N 78°56'56.29"E | -3202 | -5352 | 65.5 | 0 | 65.5 |
| AAQ6 | 10°52'2.04"N 79° 0'4.62"E | 2545 | -3534 | 66.8 | 0 | 66.8 |
| AAQ7 | 10°56'36.68"N 78°56'50.09"E | -3394 | 4923 | 67.1 | 0 | 67.1 |
| AAQ8 | 10°57'29.63"N 78°58'7.87"E | -1019 | 6555 | 60.2 | 0 | 60.2 |

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 $\mu\text{g}/\text{m}^3$ for PM_{10} , SO_2 & NO_x respectively. By adopting suitable mitigation measures, the pollutant levels in the atmosphere can be further being controlled.

4.4.3 Mitigation Measures

In the study area adequate control measures will be implemented at the time of quarrying operation. Mitigation Measures suggested for air pollution controls are based on the baseline ambient air quality of the area. From the point of view of maintenance of an acceptable ambient air quality in the region, it is desirable that air quality is monitored on a regular basis to check compliance of standards as prescribed by regulatory authorities. In case of non-compliance, appropriate mitigated measures need to be checked.

The following additional measures will also be adopted such as:

- * Water sprinkling on haul roads, service roads will help in reducing considerable dust pollution
- * Closed Cabins with AC for shovel and dumpers and dust masks to workers will be provided
- * Weekly maintenance of quarrying equipment's will be carried out
- * Transport of sand in trucks covered with tarpaulin.
- * Information on wind direction and meteorology will be considered while planning, so that pollutants, which cannot be fully suppressed by engineering technique, will be prevented from reaching the nearby agriculture area.
- * Comprehensive green belt in the river bund will be carried out to reduce to propagation of fugitive dust emissions in order to create clean and healthy environment.
- * The vehicles and machinery will be kept in well maintained condition so that emissions will minimize
- * PPE will be provided to all workers
- * Regular health check-up of workers and nearby villagers in the near vicinity of the project area will be carried out and also yearly occupational health assessment of employees will be carried out as per DGMS Guidelines.
- * Ambient Air Quality Monitoring will be conducted on half-yearly basis to assess the quality of ambient air.

4.5 NOISE ENVIRONMENT

Noise pollution is mainly due to operation like drilling & blasting and plying of trucks & HEMM. In this mining operation drilling and blasting is not involved hence noise is only due to the movement of HEMM and tippers.

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.

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.

Predicted noise levels due to mining operations using Mathematical Equations

$$L_2 = L_1 - 20 \log_{10} (R_2/R_1)$$

Where L_1 dB(A) = Noise level at a distance R_1 (m)

L_2 dB(A) = Noise level at a distance R_2 (m)

&

$$L = 10 \log_{10} (10^{L_1/10} + 10^{L_2/10} + \dots + 10^{L_n/10})$$

Where L_1 , L_2 and L_n are noise level dB(A)

Table 4.7: Anticipated Noise levels

| S. No | Locations | Noise level (dB (A) Leq) | | Ambient Noise Standards |
|-------|-----------|--------------------------|------------|-------------------------|
| | | Day Time | Night Time | |

| 1 | Near Project Area | 43.3 | 35.3 | Industrial |
|---|-------------------|------|------|--|
| | | | | Day Time- 75 dB (A) Night Time- 70 dB (A) |
| 2 | Poreyari | 40.3 | 35.4 | Residential Day Time- 55 dB (A) Night Time- 45 dB (A) |
| 3 | Kandiratheertham | 38.0 | 34.4 | |
| 4 | T.Kallikudi | 37.2 | 36.0 | |
| 5 | Thirukattupalli | 39.7 | 36.5 | |
| 6 | Konerirajapuram | 36.3 | 34.3 | |
| 7 | Pudurpalayam | 37.9 | 35.2 | |
| 8 | Vilagam | 36.6 | 34.4 | |

The anticipated noise level found in the range of 43.3 dB (A) in Core zone and 35.3dB (A) in Buffer zone. The thick green belt development will be carried out around the project area. Hence, the noise level will get reduced while quarrying. The noise level at different receptors 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 without considering the barrier effect. From the above table, it can be seen that the ambient noise levels at all the locations will remain within permissible limits even when the project will be in operation phase after getting EC.

Mitigation Measures

- * Provision of earplugs to workers exposed to high noise generating activities. Workers and operators at work site will be provided with earmuffs
- * Noise generated by the machinery will be reduced by proper lubrication of the machinery and other equipment
- * Conducting periodical medical checkup of all workers for any noise related health problems.
- * Proper training to personnel to create awareness about adverse noise level effects
- * Periodic noise monitoring at suitable locations in the mining area and nearby habitations to assess efficacy of adopted control measures

4.6 BIOLOGICAL ENVIRONMENT

The impact on biodiversity is not anticipated as there are no Wild life sanctuaries, Eco sensitive zone within the radius of 10Km from the project site. The impact on biodiversity is difficult to quantify because of its diverse and dynamic characteristics.

There are no migratory corridors, Migratory avian-fauna, and rare endemic and endangered species. There are no wild animals in the area. No breeding and nesting site were identified in project site. No National park and Wildlife Sanctuary found within 10km radius. The low concentrations of NOx due to mine operation of the proposed quarry will have insignificant impact on ambient air quality and NOx concentration will remain within the NAAQ standards and will not have an impact on the biological environment.

Mining activities generally result in the deforestation, Land degradation, Water, Air and Noise pollution that 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.

Anticipated impacts and mitigation measures:

- * The proposed project of riverbed sand mining shall be carried out on the riverbed of the Kollidam River. There are no trees in the project area. The project shall also not lead to any change in land use and will be replenished every year after successive rains. The proposed mining activity, which although is an economically gainful activity, also constitutes river training work. There shall be negligible air emissions or effluents from the project site during the loading of the truck. This shall be a temporary effect and not anticipated to affect the surrounding Vegetation significantly.



- * Animals are sensitive to noise and avoid human territory. The project stretch of the river is not an identified drinking water point for the animals. However, any animal desirous of accessing the river can continue to do so upstream or downstream of the stretch during the mining activities, as there will not be any damming or diverting of water. Hence, no significant impact is anticipated from the proposed project.
 - * To reduce the adverse effects on flora/fauna status of the area due to deposition of dust generated from mining operations, water sprinkling systems will be installed in all dust prone areas to arrest dust generation. Methodical and well-planned plantation scheme will be carried out
 - * The river bund will be utilized for Greenbelt development with native species like Neem, coconut, Pungan etc.,
 - * Development of dense poly-culture plantation using local flora species in the mining area at conceptual stage.
 - * There's no breeding/ nesting sites of birds and animals in the nearby areas
- To control the dust deposition in the nearby lands and vegetation, water will be sprinkled in the haul road, approach road and dust prone areas.

Systematic plantation will be carried out in the phased manner in every year. Three tier plantations will be carried out to arrest the dust.

4.7 SOCIO ECONOMIC ENVIRONMENT

The socio-economic impacts of quarrying operation are many. Impacts of a mine project may be positive or Negative. The adverse impacts attribute to physical displacement due to land acquisition, which is followed by loss of livelihood, mental agony, changes in social structure, and risk to food security etc.,

The villages and their inhabitants in the buffer zone will not be disturbed from their settlements due to the mining operations. There is no habitation within the project area and within the radius of 500m from the periphery of the project site. Therefore, neither villages nor any part of village or any hamlet will be disturbed during the short period of the mine. Regular medical checkup / eye-camps will be organized for the villagers. This quarry project will provide job opportunities to 40 workers directly and 20 workers indirectly. Employed for mining work earning wages as per the minimum wages act applicable for un-skilled, semi-skilled and highly skilled categories.

4.8 OCCUPATIONAL HEALTH RISKS

4.8.1 Anticipated Impact

The problem of occupational health, in the operation and maintenance phases is primarily due to dust, which could affect breathing. Health and Safety Measures to control dust inhalation; precautions would be adopted to prevent dust generation at site and dispersing in the environment. Long– term exposure to silica dust may cause silicosis. Workers are likely to get exposed to excessive noise levels during quarrying activities. Occupational Safety hazards related to blasting activities may result in accidental explosions, if not properly mitigated.

Anticipated occupational and safety hazards

- * Health Impact due to Physical activity,
- * Respiratory hazards due to Dust exposure
- * Physical hazards

Anticipated occupational illness sequel to mining activities can be as follows:

- * Dust related pneumonia
- * Segmental vibration \

4.8.2 Mitigation measures

To reduce pollution emanation from the project, following measures will be taken:

- * Water sprinkling on haul roads
- * Green belt development to arrest dust and reduce noise propagation
- * Acceptance of good control measures for reducing air pollution,
- * Control of noise levels through good preventive maintenance of machineries, green belt development, provision of earmuffs to workers, etc.,

In addition to above measures, the following remedial steps will be enforced to ensure minimization of occupational health and safety problems.

- * Medical examination of workers at pre-entry level stage of workers, etc., by qualified doctors, with periodical examination of all workers/staff at least once a year, as per DGMS circulars.
- * Provision of First aid facility as necessary
- * Organization of medical camps at nearby villages for treatment of patients, especially senior citizens, children and ladies.
- * All staff and workers will be provided with PPE to guard against excess noise levels, Dust generation and inhalation, etc., as per standards prescribed by DGMS.

4.8.3 Post COVID Health Management Plan for Workers

The following Health Management plan will be strictly implemented in the Mines, mine officials like Mines Manager and Foreman will be Act as a Controller of Health Management of the workers.

- Temperature will be checked to all the workers while arriving to work on each day
- If any persons/employees have fever of 100.4 or higher, chills, shortness of breath will be sent to Hospital and the persons will be employed after fourteen days
- All the persons inside the mine area instructed to wear fabric or disposable pleated masks covering Nose and Mouth
- Social distancing of 6feet will be maintained all the time
- Temporary Hand washing points will be installed near the working places, workers will be initiated to Wash hands frequently with soap and water for a minimum of 20 seconds and advised to avoid touching face. This is an essential contagion-control mechanism

CHAPTER – 5: ANALYSIS OF ALTERNATIVES (TECHNOLOGY AND SITE)

5.0 INTRODUCTION:

The mining project is site specific and this is specific project for restoring the functional efficiency of river and no alternate sites are proposed. Consideration of alternatives to a project proposal is a requirement of EIA process. There is no ore beneficiation, mineral processing proposed in the project. The entire quarried out sand will be directly located tippers and will be sent to Government Stock yard unit.

No workshops, housing, colonies are proposed within the project area. The workers are being employed from the nearby community/ villages; hence, there is no impact on selection of alternates.

5.1 ANALYSIS OF ALTERNATIVE TECHNOLOGY

There are no changes in the method of mining and technology. The methodology will be carried out as per the Mining plan approved by Department of Geology and Mining. The mineral deposits are site specific in nature; hence, question of seeking alternate site does not arise for this project.

CHAPTER – 6: ENVIRONMENTAL MONITORING PROGRAMME

6.0 INTRODUCTION

Environmental Monitoring will be taken up for various environmental components as per conditions stipulated in Environmental Clearance Letter issued by MoEF & Consent to Operate issued by the State Pollution Control Board. Monitoring reports will be submitted to regulator as per statutory requirements. The entire monitoring work will be carried out by MoEF & CC / NABL recognized laboratories.

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.

6.1 MEASUREMENT & METHODOLOGIES

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).

The environmental monitoring for the quarry operations will be conducted as follows:

- * Micro-Meteorological data
- * Ambient Air Quality
- * Water quality and water level
- * Ambient and work zone Noise levels
- * Soil Quality and
- * Greenbelt Development

With the knowledge of baseline conditions and continuous post project monitoring, the levels of various environmental attributes can serve as an indicator for any deterioration in environmental conditions due to mining operations and suitable mitigation steps could be taken in time to safeguard the environment.

6.2 MONITORING SCHEDULE AND FREQUENCY

Monitoring programme will be followed till the quarry operation ceases; as per the schedule below.

Table 6.1: Monitoring Schedule

| 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 | Noise | 2 Locations (1 Core & 1 Buffer) | Hourly – 1 Day | Once in 6 months | Leq, Lmax, Lmin, Leq Day & Leq Night |
| 5 | Soil | 2 Locations (1 Core & 1 Buffer) | - | Once in six months | Physical and Chemical Characteristics |
| 6 | Greenbelt | Within the Project Area | Daily | Monthly | Maintenance |

6.3 IMPLEMENTATION SCHEDULE OF MITIGATION MEASURES

The mitigation measures suggested in Chapter - IV will be implemented to reduce the impact on environment due to the operations of the proposed project. As the mitigation measures with respect to Land, Soil, Water, Air, Noise and Ecological Environment will be implemented immediately as project progress.

6.4 ENVIRONMENTAL MONITORING CELL

For the two years quarrying operation Environmental Monitoring Cell will be formed under the control of Mines Manager. A statutory competent qualified person will be appointed, for looking after the environmental monitoring and compliance with the conditions stipulated in the Environmental clearance for the mines. The environmental monitoring programme will be carried out by external agency approved by MoEF/ NABL for conducting the monitoring.

6.5 BUDGETARY PROVISION FOR ENVIRONMENTAL MONITORING

The cost in respect of monitoring of environmental attributes, parameter to be monitored, sampling/monitoring locations with frequency and cost provision against each 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. 50,000/- and the recurring cost is Rs. 2,75,000/- per annum.

Table 6.2: Environment Monitoring Budget

| S.No. | Parameter | Capital Cost | Recurring Cost per annum |
|--------------|------------------|--------------------|--------------------------|
| 1 | Air Quality | - | Rs 25,000/- |
| 2 | Meteorology | - | Rs 50,000/- |
| 3 | Water Quality | - | Rs 25,000/- |
| 4 | Water Sprinkling | - | Rs 50,000/- |
| 5 | Soil Quality | - | Rs 50,000/- |
| 6 | Noise Quality | - | Rs 25,000/- |
| 7 | Greenbelt | Rs 50,000/- | Rs 50,000/- |
| Total | | Rs 50,000/- | Rs 2,75,000/- |

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. In addition, items identified by public and other stakeholders will be incorporated after Public Hearing.

- * Public Consultation
- * Risk Assessment
- * Disaster Management plan
- * Open pit slope Stability Analysis

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

Risk assessment is a process whereby risks are analyzed, assessed and risk management priorities are evaluated. It is defined as the characterization of the potential adverse effect to human health & environment due to environmental hazards.

Risk assessments will help the mine operators to identify high, medium and low risk levels. Risk assessments will help to prioritize risks and provide information on the probability of harm arising and severity of harm by understanding the hazard, combine assessments of probability and severity to produce an assessment of risk and it is used in the assessment of risk as an aid to decision making.

Any mines have dangers or risk like fires, inundation, failure of machinery, which need to be investigated, addressed and mitigated. Preliminary Risk assessment is based on the philosophy that “Prevention is better than cure”. The mining operations will be carried out under supervision of statutory personnel’s as per provisions of MCR 1960, MCDR 1988, Mines Rules 1955, Mines Act 1952 & strictly following safety aspects as per MMR 1961 monitored by Directorate General of Mines safety.

Table 7.1 Risk Assessment & Control Measures

| S. No | Risk factors | Causes of risk | Control measures |
|-------|----------------|--|---|
| 1 | Transportation | Potential hazards and unsafe workings contributing to accident and injuries Overloading of material | <ul style="list-style-type: none"> ▪ 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. |

| | | | |
|---|--------------------|--|--|
| | | While reversal & overtaking of vehicle Operator of truck leaving his cabin when it is loaded. | <ul style="list-style-type: none"> ▪ Not allow any unauthorized person to ride on the vehicle nor allow any unauthorized person to operate the vehicle. ▪ Concave mirrors should be kept at all corners ▪ All vehicles should be fitted with reverse horn with one spotter at every tipping point ▪ Loading according to the vehicle capacity ▪ Periodical maintenance of vehicles as per operator manual |
| 2 | Natural calamities | Unexpected happenings | <ul style="list-style-type: none"> ▪ Escape Routes will be provided to prevent inundation of storm water ▪ Fire Extinguishers & Sand Buckets |

7.2 DISASTER MANAGEMENT PLAN

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 the affected and provide 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.

Planning –

Possible emergency situations can broadly be classified into vehicle collision, and inundation. Some of the ways of preventing emergencies are as follows:

- Preparation of a Preventive Maintenance Schedule Programme and also covering maintenance schedules for all mining machinery/equipment and instruments as well as transport vehicles as per recommendations of the manufacturers user manuals
- Ensuring the compliance of traffic rules strictly on haul roads within the project area as well as outside the project area
- Establishment of an ongoing training and evaluation programme, incorporating the development of capabilities amongst employees about potential emergencies and ways and means of identifying and averting the same
- Most emergencies do not occur without some incident or an abnormal situation. So, there is always sometime of few seconds to few minutes to arrest an incident of abnormal situation from turning in to an emergency

Implementation –

Following key personnel, identified for carrying out specific and assigned duties in case of any kind of emergency, shall be available on call on holidays and off duty also.

- PWD Engineer
- Personnel Officer
- Foreman
- Supervisor
- Essential workers

Responsibilities of PWD Engineer

- To take overall charge at the place of incident and activate the Emergency Preparedness Plan according to severity of situation
- Inform doctor to be ready for treatment of affected employees and intimate their relatives.
- To depute staff, carry out following functions -
 - To supervise assembly and evacuation at all points
 - To look after patients casualties and give psychological support
- Inform Police department and District Emergency Authority
- Arrange for chronological records of emergency to be maintained
- Issue authorized statements to news media.

7.3 RECLAMATION AND REHABILITATION

The Main objective of this projects to desilt the sand and enhance the functional efficiency of the river. The sand which has accumulated over a long period of time. This accumulated sand has decrease flowing capacity of the river. It is vital and significant to excavate the sand at present scenario to restore its original capacity. There is no waste hence, no proposal for backfilling or reclamation. The sand will get replenishment naturally during the upcoming rainy seasons.

CHAPTER – 8: PROJECT BENEFITS

8.0 INTRODUCTION

This Sand Quarry project aims to restore the functional efficiency of the Coleroon River by excavating 7,68,000m³ of Sand for a period of 2 years. This will reduce demand and supply gap in the construction industries.

The enhancement of production will result the following benefits.

- ✚ Improvement in Physical Infrastructure.
- ✚ Improvement in Social infrastructure.
- ✚ Increase in Employment Potential.
- ✚ Revenue to Both Central Govt. & State Govt.
- ✚ Post mining Enhancement of Green cover.
- ✚ Supply – Demand chain of cement will be maintained without demand to the state.



This chapter gives a comprehensive description of various advantages and benefits anticipated from the project to the locality, neighborhood, region and nation as a whole. Sand will be directly loaded into tippers to the needy customers and silt will be distributed to the neighboring farmers for their agriculture purposed with free of cost.

8.1 PROJECT BENEFITS

Physical and Social infrastructure to the Community

- * Improved road communication,
- * Strengthening of existing community facilities through the existing Community Development Program.
- * Greenbelt will be carried out in the project area to improve the vicinity and environment of mine and its surrounding area.
- * Awareness programme and community activities, like health camps, medical aids, family welfare programmes, immunization camp sports & cultural activities, plantation etc.,
- * Providing essential facilities for the local schools and primary health centers in the nearby villages



8.2 BENEFITS TO LOCAL AND REGIONAL ECONOMY

- * It will generate revenue for the State of Tamil Nadu
- * Direct employment to skilled/unskilled and semiskilled laborers.
- * Indirect employment to local people in different activities such as transportation, food points, plantation activities, water tanker supply, hand equipment's etc.
- * Generation of self-employment through self-help groups.

8.3 EMPLOYMENT POTENTIAL

The local labors shall be engaged for supervising during loading and handling of mineral in mining area, besides, watch and ward and plantation activity with proper maintenance. The total manpower required for material handling and loading, skilled and managerial staff to meet the statutory requirement under MMR 1961 and MCDR 1988 is 40 Nos. The following skilled / unskilled and semi-skilled workers besides managerial and administrative staff shall be employed preferentially from the nearby villages.

8.4 TANGIBLE SOCIAL BENEFITS

There will be positive impact in socio-economic area due to increased economic activities, creation of new employment opportunities, infrastructural development and better educational and health facilities.

8.4.1 Corporate Social Responsibility

It is a public and Government Bonafied project. Hence CER does not involve this project. If any recommended by SEIAA for CER activity, will be followed by the PWD.

Conclusion: -

Due to the project the benefits are given below

- The Direct employment opportunity to the 40 local community people and indirect employment about 20 peoples in various sector.
- The local community will benefit financially like increased income level due to job opportunity.
- The proponent will undertake awareness programme and community activities like health, camps, medical aids, family welfare camps, medical awareness programme etc., Periodic medical checkups as per Mines Act/ Rules and other social development and promotional activities will be undertaken. All this will assist to lift the general health status and enhance the standards of the communities of the area around mines.

CHAPTER – 9: ENVIRONMENTAL COST BENEFIT ANALYSIS

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

CHAPTER - 10: ENVIRONMENTAL MANAGEMENT PLAN

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 LAND ENVIRONMENT MANAGEMENT

- Mining operation will not be carried out near the river banks to protect the bank erosion and river mitigation.
- Slopes of the sides will be kept 45⁰ to prevent erosion
- The excavated area shall be replenished during the upcoming rainy seasons.
- The removal of sand will have only positive impact on the river it will enhance the carrying capacity of the river.

10.2 AIR ENVIRONMENT MANAGEMENT

The project is proposed to be carried out without involving drilling and blasting, the mineral will be excavated with the help of Excavator and loaded into the tippers. Therefore, the dust propagation due to Drilling and blasting does not arise.

During the course of mining no toxic substances are released into the atmosphere, gaseous emission only due to the vehicles. It will be controlled by using PUC certified vehicles.

Greenbelt development program will be carried out approach roads and village roads to control the dust emission during operation. A well Standard Operating Procedure will be practiced in the HEMM to reduce gaseous emission and dust propagation.

Table 10.1: Air pollution management and control

| Potential impact | Action | Parameters for monitoring | Timing |
|------------------|---|--|------------------------------------|
| Air Emission | Optimum loading of mineral to minimized to the extent possible | Vehicle logs / optimum capacity of vehicle | During operational phase. |
| | Ambient air quality within the premises of the proposed unit to be monitored. | The ambient air quality will conform to the standards for SPM, SO ₂ and NO _x | As per CPCB and TNPCB requirement. |

Controlling of Air Environment.

- * Water will be sprinkled twice a day in the approach roads and village roads to wet the surface
- * Overloading of material will be avoided to prevent spillage.
- * The mineral will be covered with tarpaulin to prevent the spillage during transportation and the material will be transported only to the Needy customers and Neighboring Formers.
- * Vehicles will be regularly checked and maintained as per the RTO and TNPCB Norms.

10.3 NOISE AND VIBRATION MITIGATION:**Table 10.2: Noise and Vibration Mitigation**

| Potential impact | Action | Parameters for monitoring | Timing |
|--|---|---|--------------------------------|
| Noise | Noise will be generated only during the movement of HEMM and Tippers, implement good working practices (equipment selection and siting) to minimize noise and also reduce its impacts on human health (ear muffs, safe distances and enclosures). | Site working practices records, noise reading | During Excavation. |
| | Noise to be monitored in ambient air in the working place | Noise reading | As per TNPCB/ MoEF & CC norms. |
| Ground vibration due to Movement of HEMM | Controlled customized working techniques will be implemented under the supervision of Mines Manager | Vibrations to be Modeled and customized. | At the time of working. |

Control of Noise and vibration during movement of HEMM and Tippers:

- * Hydraulic Excavator with Sound proof cabin shall be used for the excavation of mineral.
- * In order to reduce the effect of noise pollution, earmuffs will be provided to all operators and employees working at mining site as a safety measure.
- * Proper maintenance, oiling and greasing of machines at regular intervals will be done to reduce generation of noise.
- * Periodical monitoring of noise level near the project site and nearest village from the mine will be done with the help of sound level meter & records will be maintained.

10.3 WATER MANAGEMENT & POLLUTION CONTROL

There is no processing and mineral beneficiation within in the project area. No workshop is proposed in the quarry area the major machinery repair work will be carried out in the nearby major town hence effluent due to oil and grease is very minimal.

Domestic effluent is mainly sewage only, septic tank with soak pit arrangement will be provided at the mine site.

The proposed depth of the quarry is 3.2m (2.2m abl + 1.0m bbl), the quarrying operation will not intersect the ground water table.

SURFACE WATER MANAGEMENT

The project area is Coleroon River, mining operation will be carried out only during the non flow of river water.

GROUND WATER MANAGEMENT

The water table in the area is 12m BGL (Below ground level) during pre-monsoon and 16m BGL (Below ground level) during post monsoon season. Water table will not be intersected during any stage of mine life. Hence contamination of ground water is redundant.

DETAILS OF WATER CONSERVATION MEASURES PROPOSED

The Main objective of this Projects is to restore the functional efficiency of the river by removal of Sand over the river bed. The sand which has accumulated has been not removed due to cost constrained. This accumulated sand and decreased carrying capacity of River. It is vital and significant to desilt the sand and silt at present scenario to restore its original capacity.

10.4 LAND RECLAMATION AND WASTE MANAGEMENT

No mineral wastages anticipated. The Main objective of this projects restore the functional efficiency of the river. The quarried out land will be naturally reclaimed during the rainy seasons.

10.5 BIOLOGICAL ENVIRONMENT

The proponent 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 on the river bund, village road and nearby school ground consultation with the panchayat authorities.

Following control measures are proposed for its management and will be the responsibility of the Mines Manager.

- Greenbelt development all along the river bund, village roads
- The main attributes that retard 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

10.8.1 Green Belt Development Plan

About 12,000nos. of saplings is proposed to be planted for the Mining plan period in village road, School ground and nearby village roads with survival rate 80%. 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 10.3 Proposed Greenbelt Activities For 2 Year Plan Period

| Year | No. of tress proposed to be planted | Area to be covered | Name of the species | Survival rate expected in % |
|------|-------------------------------------|------------------------------|--|-----------------------------|
| I | 12000 | River bund and Village roads | Neem, Pungam, Sengondrai, Panai, Naval | 9600 |

Source: Conceptual Plan of Approved Mining plan& proposed by FAE's & EIA Coordinator

The objectives of the greenbelt development plan are –

- Provide a green belt in the river bund, village road and School ground
- 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.

A well-planned Green Belt with multi rows (three tiers) preferably with dense 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 10.4: Recommended Species to Plant in the Greenbelt

| S.No | Botanical Name | Local Name | Importance |
|------|----------------------|--------------|--|
| 1. | Azadirachta indica | Neem, Vembu | Neem oil & neem products |
| 2. | Borassus Flabellifer | Palmyra Palm | Tall Wind breaker tree and its fruits are edible |

Source: Proposed by FAE's & EIA Coordinator

10.9 OCCUPATIONAL SAFETY & HEALTH MANAGEMENT

Occupational safety and health are 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 detail 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 10.5: Medical Examination Schedule

| Sl.No | Activities | 1 st Year | 2 nd 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) | | |

| Age Group | PME as per Mines Rules 1955 |
|------------------------|-----------------------------|
| Less than 25 years | Once in a Three Years |
| Between 25 to 40 Years | Once in a Three Years |
| Above 40 Years | Once in a Three Years |

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.
- 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.
- 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.
- 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 Program

The Proponent 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 Environmental Consultants to provide periodical training to all the employees to carry out the mining operation in and eco-friendly manner.

Table 10.6: 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 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 10.11 gives overall investment on the environmental safeguards and recurring expenditure for successful monitoring and implementation of control measures.

Table 10.7: EMB Budget

| Activities | 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 | 240000 | 240000 |
| | water will be sprinkled using rental water tankers | Rs 200 per tank - Two times per day | 0 | 120000 |
| | No overloading of trucks/tippers/tractors | Manual Monitoring through Security guard | 0 | 5000 |
| | Sand 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 Governors @ Rs. 5000/- per Tipper/Dumper deployed - 15 Unit | 75000 | 3750 |
| | 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 | 480000 |
| | 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 |
| 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 |
| Green Belt Development | 1. Progressive Closure Activity Green belt development - 500 trees per one hectare - Proposal for 12000 Trees - (will be planted in the nearby village roads) | Site clearance, preparation of land, digging of pits / trenches, soil amendments, transplantation of saplings @ 300 per plant (capital) for plantation inside the lease area and @ 30 per plant maintenance (recurring) | 3600000 | 360000 |
| | 2. 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 | 9216000 | 0 |
| Implementation of EC, Mining | Size 6' X 5' with blue background and white letters as mentioned in | Fixed Display Board at the Quarry Entrance as permanent structure | 10000 | 1000 |

| Plan & DGMS Condition | MoM Appendix II by the SEAC TN | mentioning Environmental Conditions | | |
|----------------------------------|---|--|---------------------|---------------------|
| | 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) - 40 Employees | 160000 | 40000 |
| | Health check up for workers will be provisioned | IME & PME Health check up @ Rs. 1000/- per employee | 0 | 40000 |
| | First aid facility will be provided | Provision of 2 Kits per Hectare @ Rs. 2000/- | 0 | 48000 |
| | Mine will have safety precaution signages, boards. | Provision for signages and boards made | 10000 | 2000 |
| | 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 | Mining Mate under regulation 116 of MMR,1961 | 0 | 180000 |
| TOTAL | | | Rs.41,85,000 | Rs.16,31,750 |

CHAPTER – 11: SUMMARY AND CONCLUSIONS

Virahalur Sand quarry (Extent: 24.00.0 ha) falls under “B1” 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 impact in the study area due to this sand mining project and formulate the effective mitigation measures. 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 December 2022 to February 2023 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 Sand as per market demand.

Sustainable and modern mining leads us to see positive impact of mining operation and providing consistent employment for nearly 40 people directly in the cluster and indirectly around 20 people.

As discussed, it is safe to say that the proposed quarry is 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 Virahalur Sand Quarry (Extent: 24.00.0 ha)

12.0 DISCLOSURE OF CONSULTANTS ENGAGED

The proponent has engaged M/s Geo Exploration and Mining Solutions is an Accredited Organization under Quality Council of India – National Accreditation Board for Education & Training, New Delhi.

Name and address of the consultants carried out the EIA studies:

GEO EXPLORATION AND MINING SOLUTIONS

No 17, Advaita Ashram Road,

Alagapuram, Salem – 636 004

Tamil Nadu, India

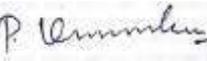
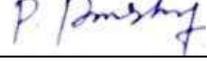
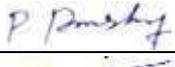
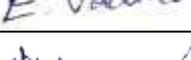
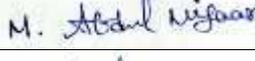
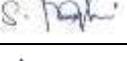
Email: infogeoexploration@gmail.com

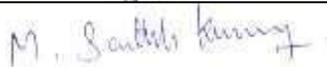
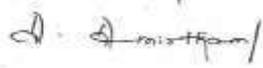
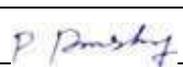
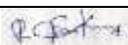
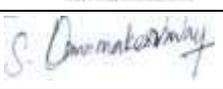
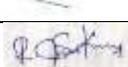
Web: www.gemssalem.com

Phone: 0427 2431989

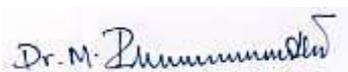
The accredited Experts and associated members are engaged for this EIA study as given below.

Table 12.1: Details of Experts involved in the project

| S.No | Functional Areas | | Name of the expert | In house/ Empanelled | Signature |
|------|------------------|-----|------------------------|----------------------|---|
| 1 | WP | FAE | Dr. M. Ifthikhar Ahmed | IH |  |
| | | FAA | Mr. N. Sathish Kumar | IH |  |
| | | TM | Mr. S.Nagamani | IH |  |
| | | | Mr. P.Viswanathan | |  |
| | | | Mr. M.Santhoshkumar | |  |
| 2 | AQ | FAE | Mr. N. Senthil Kumar | EMP |  |
| | | | Mr. P.Panneer selvam | IH |  |
| 3 | AP | FAE | Mr. A. Jagannathan | IH |  |
| | | TM | Mr. G.Imram Khan | IH | |
| | | | Mr. P.Panneer selvam | IH |  |
| 4 | NV | FAE | Mr. A. Jagannathan | IH |  |
| | | TM | B.Venkata Giri | IH |  |
| | | | E.Vadivel | |  |
| 5 | GEO | FAE | Dr. P. Thangaraju | IH |  |
| | | FAA | Mr. Abdul Nisaar | IH |  |
| | | TM | Mr. S.Nagamani | IH |  |
| 6 | HG | FAE | Dr. P. Thangaraju | IH |  |

| | | | | | |
|----|----|-----|--------------------------|----|---|
| | | FAA | Mr. L. Jayaraj | IH |  |
| | | TM | Mr. M.Santhoshkumar | IH |  |
| 7 | LU | FAE | Mr. A. Allimuthu | IH |  |
| | | TM | Mr. M.Santhoshkumar | IH |  |
| 8 | EB | FAE | Mr. Amirtham Sakthivel | IH |  |
| | | TM | Mr. P.Panneer selvam | IH |  |
| 9 | SC | SC | Dr. M. Ifthikhar Ahmed | IH |  |
| | | TM | R. Sivakumar | IH |  |
| 10 | SH | FAE | Mr. J. R. Vikram Krishna | IH |  |
| | | | R.Sivakumar | IH |  |
| | | TM | S.Uma Maheshwaran | IH |  |
| 11 | SE | FAE | Mrs. K. Anitha | IH |  |
| | | TM | J.Kannan | IH |  |
| | | TM | R.Sivakumar | IH |  |

Signature

: 

Name

: **Dr. M. Ifthikhar Ahmed**

(Authorized Signatory)

Designation

: **EIA Coordinator**

Name of the EIA

Consultant organization

: **M/s. Geo Exploration and Mining Solution**

NABET Certificate no. &

Issue Date

: **NABET/EIA/2225/RA0276 dated 20.02.2023**

Valid

: **valid upto 06.08.2025**

| 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 |
| BGL | Below Ground Level |
| MSL | Mean Sea Level |
| AMSL | Above Mean Sea Level |