# DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT

# For
# RAJAKKAL MULTI COLOUR GRANITE QUARRY
# OVER AN EXTENT OF 46.07.0 Ha

**At**
**Survey No.: 311 (Part)**
**Rajakkal Village**
**Pernambut Taluk (erstwhile Gudiyatham Taluk)**
**Vellore District**
**Tamil Nadu State**

**By**

**M/s. Tamil Nadu Minerals Limited**
**No. 31, Kamarajar Salai**
**Chepauk**
**Chennai – 600 005**

**(Project termed under Schedule of 1(a) Mining of Minor Minerals 'B1' category as per EIA Notification 2006 and its Amendments & Project falls under Violation category as per S.O. 804 (E) dated 14th March 2017)**

**EIA Consultant**

**HUBERT ENVIRO CARE SYSTEMS PRIVATE LIMITED, CHENNAI**

**MAY 2023**

# ACKNOWLEDGEMENT

The following personnel are gratefully acknowledged for their fullest support in collection, compilation of needful data regarding the project and kind cooperation in fulfilling the report on Environmental Impact Assessment (EIA) report of Revised Scheme of Mining for Rajakkal Colour Granite Quarry over an extent of 46.07.0 Ha Survey No.311 (Part), Rajakkal Village, Pernambut Taluk (erstwhile Gudiyatham Taluk), Vellore District, and Tamil Nadu State.

**M/s. Tamil Nadu Minerals Limited,**

1) Mr. E Ganesan- Deputy Manager (ML)

**M/s. Hubert Enviro Care Systems Private Limited,**

1) Dr. J R Moses (CEO)
2) Dr. Raj Kumar Samuel (Director – Technical)
3) Mr. Vamsee Krishna Navooru (Head Consultant)

## Declaration by the Project Proponent

I, Dr. E Ganesan, Deputy Manager (ML) of M/s Tamil Nadu Minerals Limited, declaration/ undertaking that owing the contents (information and data) of the EIA report preparation has been undertaken in the compliance with Terms of Reference (ToR) for the "**Rajakkal Colour Granite Quarry over an extent of 46.07.0 Ha Survey No.311 (Part), Rajakkal Village, Pernambut Taluk (erstwhile Gudiyatham Taluk), Vellore District, and Tamil Nadu State**." and the information and content provided in the report are factually correct.

for Tamil Nadu Minerals Ltd,

Authorised signatory
Deputy Manager (ML)
TAMIN - Chennai

## Declaration by the Head of the Accredited Consultant Organization

I, Dr.J.R. Moses, hereby, confirm that the below mentioned experts prepared the EIA/EMP for Revised Schme of Mining for **Rajakkal Colour Granite Quarry over an extent of 46.07.0 Ha Survey no.311 (Part), Rajakkal Village, Pernambut Taluk (erstwhile Gudiyatham Taluk), Vellore District, and Tamil Nadu State**. I also confirm that I shall be fully accountable for any misleading information mentioned in this statement.

Signature:

Date: 31.05.2023

**Name:** Dr.J.R.Moses

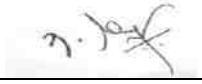
**Designation:** Chief Executive Officer

**Name of the EIA Consultant Organization:** M/s. Hubert Enviro Care Systems (P) Ltd, Chennai

**NABET Certificate No & Validity:** NABET/EIA/2224/SA 0190 & valid upto July 27, 2024

## Declaration of Experts contributing to the EIA

I, hereby, certify that I was involved in the EIA report for the project titled Revised Schme of Mining for **Rajakkal Colour Granite Quarry over an extent of 46.07.0 Ha Survey no.311 (Part), Rajakkal Village, Pernambut Taluk (erstwhile Gudiyatham Taluk), Vellore District, and Tamil Nadu State.** I was a part of the EIA team in the following capacity that developed the above EIA with the support of the following Functional Area Experts.

| **EIA Coordinator:** |
|---|
| Name: Mr. Vamsee Krishna Navooru |
| Signature:  |
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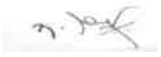
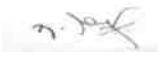
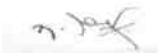
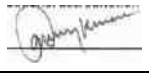
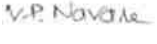
**Functional Area Experts (FAEs)**

| S. No. | Functional Areas | | Name of the Expert | Signature | Duration of Involvement |
|---|---|---|---|---|---|
| 1. | AP | FAE | Mr. Vamsee Krishna Navooru |  | Jan 2023 to Till Date |
| 2. | WP | FAE | Mr. Vamsee Krishna Navooru |  | Jan 2023 to Till Date |
| 3. | SHW | FAE | Mr. Vamsee Krishna Navooru |  | Jan 2023 to Till Date |
| 4. | SE | FAE | Mr. V. Dhivakar |  | Jan 2023 to Till Date |
| 5. | EB | FAE | Dr. Rajkumar Samuel |  | Jan 2023 to Till Date |
| 6. | HG | FAE | Mr. Mallikarjuna Rao |  | Jan 2023 to Till Date |
| 7. | GEO | FAE | B. Mallikarjuna Rao |  | Jan 2023 to Till Date |
| 8. | NV | FAE | Mr. VivekNavare |  | Jan 2023 to Till Date |

| S. No. | Functional Areas | | Name of the Expert | Signature | Duration of Involvement |
|---|---|---|---|---|---|
| 9. | LU | FAE | Mr. Venkateswarlu |  | Jan 2023 to Till Date |
| 10. | RH | FAE | Dr. J R Moses |  | Jan 2023 to Till Date |
| 11. | SC | FAE | Dr. B.C. Nagaraja |  | Jan 2023 to Till Date |

*LU - Land Use*
*AP - Air Pollution monitoring, prevention and control*
*AQ - Meteorology, air quality modeling and prediction*
*WP - Water pollution monitoring, prevention and control*
*EB - Ecology and biodiversity*
*NV - Noise& Vibration*
*SE - Socio-economics*
*HG - Hydrology, ground water and water conservation*
*GEO - Geology*
*RH - Risk assessment and hazards management*
*SHW - Solid and hazardous waste management*
*SC - Soil Conservation*

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# List of Abbreviations

| | |
|---|---|
| AAQ | Ambient Air Quality |
| AAQM | Ambient Air Quality Monitoring |
| AGL | Above Ground Level |
| ARL | Above Roof Level |
| AMSL | Above Mean Sea Level |
| BGL | Below Ground Level |
| CPCB | Central Pollution Control Board |
| CSR | Corporate Social Responsibility |
| DMP | Disaster Management Plan |
| EAC | Expert Appraisal Committee |
| EIA | Environmental Impact Assessment |
| EMC | Environmental Management Cell |
| EMP | Environmental Management Plan |
| ETP | Effluent Treatment Plant |
| GLC | Ground Level Concentration |
| GO | Government Order |
| ISO | International Organization for Standardization |
| kWh | Kilowatt Hour |
| MSDS | Material Safety Data Sheet |
| MMR | Metalliferous Mines Regulations |
| NAAQ | National Ambient Air Quality |
| PCU | Passenger Car Unit |
| R & D | Research & Development |
| RA | Risk Assessment |
| ROM | Run of Mines |
| SOM | Scheme of Mining |
| SEIAA | State Environmental Impact Assessment Authority |
| SEAC | State Expert Appraisal Committee |
| TAMIN | Tamil Nadu Minerals Limited |
| TDS | Total Dissolved Solids |
| TNPCB | Tamil Nadu Pollution Control Board |
| TOR | Terms of Reference |
| TSDF | Treatment, Storage and Disposal Facility |
| kVA | kilo Volt Ampere |

# 1 INTRODUCTION OF THE PROJECT

## 1.1 Project Back Ground

Government of Tamil Nadu granted lease to TAMIN for quarrying colour granite over an extent of 72.44.0 Ha of Government poramboke land in SF No. 311/1 of Rajakkal Village, Pernambut Taluk (erstwhile Gudiyatham Taluk), Vellore for 10 years under Rule 8-C of Tamil Nadu Minor Mineral Concession Rules,1999 vide G.O Ms No. 458, Industries Department dated 17.11.1993.

Subsequently, Government of Tamil Nadu granted renewal of lease to TAMIN for quarrying colour granite over an extent of 72.44.0 Ha of Government poramboke land in SF No. 311/1 of Rjakkal Village, Pernambut Taluk (erstwhile Gudiyatham Taluk),, Vellore for 20 years under Rule 8-C of Tamil Nadu Minor Mineral Concession Rules,1999 vide G.O Ms (D)No. 75, Industries(MME.1) Department dated 03.09.2007. The lease period is valid up to 16.09.2027.

Meanwhile, TAMIN has preferred proposal for surrender of a portion of 26.37.0 on 15.11.2022 and the surrendere proposal of the same has been accepted by the Government and order passed vide G.O(3D) No.23, Industries (MME.1) Department , dated 14.08.2019. As of now the total lease hold area is 46.07.0 Ha (72.44.0 Ha -26.37.0= 46.07.0Ha) and there is no change in the lease period. Lease documents are enclosed as **Annexure –1**.

The Mining plan was approved with 10% recovery by the Commissioner of Geology & mining, Chennai vide letter No. 9017/MM2/2003, dated 26.03.2004. Subsequently, TAMIN submitted the Modified Mining Plan-I with 10 % recovery pertaining to the years 2008-2009 to 2012-2013 vide this office letter No.22700/ML2/2008, dated: 24.11.2008 and the same was approved by the Commissioner of Geology & Mining Chennai, vide Letter No 18349/MM5/2008, dated:10.07.2009.

As TAMIN had submitted the surrender proposal over an extent of 26.37.0Ha, the District Collector,Vellore vide Letter No.893/2014 (Mines) dated:15.10.2014,directed to submit the Revised Scheme of Mining IIover an extent of 46.07.0Ha by deleting the surrendered area of 26.37.0Ha (72.44.0Ha-26.37.0 Ha =46.07.0 Ha). Accordingly ,TAMIN submitted the Revised Scheme of Mining over an extent of 46.07.0Ha for the subject area with 10% recovery for the period 2013-2014 to 2017-2018 vide this office letter No.15738/ML2/2013,dated:03.11.2015.

By taking to consideration of deemed approval of the above Revised Scheme of Mining II under Rule 18(5) of GCDR,1999 Scheme of Mining –III for Rajakkal Colour Granite Quarry pertaining for the years from 2018-2019 to 2022 to 2023 was submitted with 10% recovery for approval vide this office Lr No.15738/ML2/2013,dated:16.11.2018.

As directed by the atuthority concerned the Revised Scheme of Mining-III for the period from 2018-2019 to 2022-2023 is prepared with 25% production recovery and submitted for approval.

Project Site Elevation is ~440m AMSL. The project falls under B1 Category, Schedule 1(a) Mining of Minerals as per MoEF&CC notification and its amendment vide S. O. 804(E) dated 14thMarch 2017.

Application for grant of Environmental Clearance was initially submitted online at SEIAA, Tamil Nadu web portal vide SEIAA-IA/TN/MIN/31357/2015, dated 29.09.2015. TAMIN commenced the mining operation of the subject area without prior Environmental Clearance under MoEF Notification dated 14.09.2006.

Hence, this is a violation project. As per MoEF & CC notification dated: 14.03.2017, Form – I and feasibility report was prepared for prescribing ToR.The EC application submission under violation (Category B1, Schedule 1(a)) at TN SEIAA vide Proposal No.SIA/TN/MIN/68470/2017 & SEIAA-File.No. 1652/2017).

The proposal was appraised under violation category during 347th SEAC meeting held on 13.01.2023 and 592nd SEIAA meeting held on 16.02.2023 and recommended for violation ToR. ToR issued vide Lr. No. SEIAA-TN/F.No1652/SEACToR-1343/2023 dated 16.02.2023 for the preparation of EIA/EMP report with ecological damage assessment, remediation plan, natural resource augmentation plan and community resource augmentation plan.

## 1.2 Purpose and Status of the Report

The quarry site is located at S.F.No.311 (Part), Rajakkal Village, Pernambut Taluk (erstwhile Gudiyatham Taluk),, Vellore District, Tamil Nadu State. The proposed lease area for mining of colour granite is 46.07.0Ha. The land use classification of the project site is government Poramboke land. The quarry lease was applied vide G.O. (3D) No. 75, Industries (MME-1) dept dated 03.09.2007 for 20 years from 17.09.2017 to 16.03. 2027. Lease documents are enclosed as **Annexure –1.**

The project falls under B1 Category, Schedule 1(a) Mining of Minerals as per MoEF&CC notification and its amendment vide S. O. 804(E) dated 14th March 2017. Application for grant of Environmental clearance was initially submitted online at SEIAA, through MoEF parivesh portal vide SEIAA-TN/F.No1652/2017,dated.13.04.2018. .TAMIN commenced the mining operation of the subject area without prior environmental clearance under MoEFnotification dated 14.09.2006. Hence, this is a violation project.As per MoEF & CC notification dated: 14.03.2017, Form – I and Pre feasibility report was prepared for prescribing ToR. The EC application was submitted under violation (Category B1, Schedule 1(a)) at TN SEIAA vide proposal No.SIA/TN/MIN/68470/2017 & File No.SEIAA-TN/F.No.1652/2017).

## 1.3 Identification of Project & Project Proponent

### 1.3.1 Identification of Project

The proposed Colour Granite Mine is over an Extent of 46.07.0 ha located in S.F.No.311 (Part), located at Rajakkal Village, Pernambut Taluk (erstwhile Gudiyatham Taluk), Vellore District, lies in the latitude of 12°50'28.48" N to 12°50'54.66" N and longitude of 78°44'28.52" E to 78°44'55.84" E. The area is marked in the survey of India Topo sheet No.57L/9 and 57L/13. The colour granite quarrying operation is proposed to carry out by opencast semi mechanized method by formation of benches. Benches are proposed with a height of 6m & width bench not less than the height. The area applied for quarry lease is exhibits hilly terrain; the altitude of the area is above ~440 m AMSL.

### 1.3.2 Project Proponent

Tamil Nadu Minerals Ltd also called TAMIN (An Undertaking of Government of Tamil Nadu) has been established in the year 1978 and it entered the international granite market in the year 1979 and has secured a steady market for dimensional blocks of black and other color materials in countries like Japan, Germany, Italy, Australia, UK, Switzerland, Holland, USA etc. TAMIN is only organization recognized by Bureau of Indian Standard for manufacture and supply of I.S. Sand all over the country. TAMIN has developed expertise in the mining of granite dimensional stones of different varieties including black granite (Dolerite), Kashmir white (Leptynite), Paradiso (Migmatite gneiss), Green onyx (Syenite - porphyry) Red wave (Pink Feldspathic gneiss) Colombo Juparana (Pegmatitic granite gneiss of migmatitic origin), Raw silk (Yellow feldspathic Lepthnite) and a number of other colored granite varieties apart from other industrial minerals viz. quartz and feldspar, graphite, lime stone, silica sand, vermiculite, etc.

### 1.3.3 Brief Description & Nature of the Project

The project falls under B1 Category, Schedule 1(a) Mining of Minerals as per MoEF&CC notification. The project falls under violation category due to the mining operation of the subject area without prior environmental clearance as per MoEF&CC gazette notification no. S.O.804 (E) dated 14$^{th}$ March, 2017.

### 1.3.4 Size of the Project

The total extent area of the lease for this quarry is 46.07.0 Ha, at S.F.No.311 (Part), Rajakkal Village, Pernambut Taluk (erstwhile Gudiyatham Taluk), Vellore District, Tamil Nadu State. Quarry Land is classified as Government Poramboke land and leased to Tamil Nadu Minerals Limited (TAMIN).

The updated geological reserves of colour granite estimated based on the geological cross-sections was 1,33,62,730m$^3$ as on 31.03.2018 by deleting the reserves depleted before mining plan period, during the modified mining plan period from (2013-2014 to 2017-2018). By applying the 25% recovery, the updated geological effective reserve as 33,40,683 m$^3$. The updated mineable reserves for colour granite

have been arrived as 1,14,57,715 $m^3$ as on 31.03.2018 after consideration of mineral locked-up in benches and safety barrier. By applying 25% recovery, the updated minerable effective reserves as 28,64,275$m^3$.

### 1.3.5 Depletion of Reserves

The depletion of Geologicl reserves during the mining plan period from 2003-2004 to 2007-2008 was 20,170$m^{3,\ during}$ scheme of mining-I period from 2008-2009 to 2012-2013 was 61,960 $m^3$ during scheme of mining –II period 2013-2014 to 2017-2018 was Nil. The cumulative depletion is 82,130 $m^3$

### 1.3.6 Location of the Project

The colour granite mine is over an extent of 46.07.0 ha located in S.F.No.311 (Part), located at Rajakkal Village, Pernambut Taluk (erstwhile Gudiyatham Taluk), Vellore District, lies in the latitude of 12°50'28.48" N to 12°50'54.66" N and longitude of 78°44'28.48" E to 78°44'55.84" E. The area is marked in the survey of India Topo sheet No.57L/9 and 57L/13. Site Elevation is ~440m AMSL. The boundary coordinates of the project site are given in **Table 1-1.**

**Table 1-1 Boundary Co-Ordinates of the Project site**

| S. No | Latitude | Longitude |
|---|---|---|
| TM1 | 12°50'56.61" | 78°44'38.90" |
| TM2 | 12°50'54.91" | 78°44'50.10" |
| TM3 | 12°50'57.05" | 78°44'50.45" |
| TM4 | 12°50'48.27" | 78°44'55.73" |
| TM5 | 12°50'48.27" | 78°44'54.90" |
| TM6 | 12°50'45.59" | 78°44'56.98" |
| TM7 | 12°50'39.54" | 78°44'56.70" |
| TM8 | 12°50'39.30" | 78°44'57.16" |
| TM9 | 12°50'36.76" | 78°44'55.35" |
| TM10 | 12°50'33.47" | 78°44'51.31" |
| TM11 | 12°50'33.13" | 78°44'49.89" |
| TM12 | 12°50'33.03" | 78°44'46.03" |
| TM13 | 12°50'32.39" | 78°44'44.01" |
| TM14 | 12°50'32.28" | 78°44'43.11" |
| TM15 | 12°50'33.64" | 78°44'42.80" |
| TM16 | 12°50'33.10" | 78°44'37.96" |
| TM17 | 12°50'31.84" | 78°44'37.86" |
| TM18 | 12°50'34.69" | 78°44'35.35" |
| TM19 | 12°50'35.30" | 78°44'29.62" |

### 1.3.7 Connectivity of the Project

The nearest railway station is Pachchakuppam railway station which is about 2.40km on South East side. The project site is adjacent to the SH 130 i.e., Gudiyatham - Vaniyambadi–approximately 0.19 km on South direction. The NH 48 Chennai - New Delhi road is around 2.30 km in the South East direction.

## 1.4 Need for the project and its importance to the country and or region

The colour granite dimensional stone material by virtue of its pleasing color and texture such as and its best ability to take polishing and appealing look in polished product has attracted the consumers in the building construction and interior decoration industries. The domestic market capabilities have also been explored in recent periods. Bulk quantity of the blocks produced are exported as raw blocks and some quantity is being processed at TAMIN's Granite processing units and exported as value added finished products.

The earning source in the targeted area is limited, most of the people in and around the area depend upon the seasonal agriculture and much of the people migrate to nearby towns where good industries and factories are growing up. Through this project will give employment opportunities to 35 direct and 20 indirect employees.

### 1.4.1 EIA Study

As a part of compliance to the regulatory requirement i.e., to obtain Environmental Clearance from SEIAA-TN, TAMIN has appointed Environmental Consultant accredited by National Accreditation Board for Education and Training (NABET)-Quality Council of India (QCI), New Delhi. The work of undertaking field studies and preparation of EIA/EMP report under B1 category was assigned to M/s Hubert Enviro Care Systems (P) Ltd. (HECS) Chennai by the project proponent. HECS is accredited by NABET, vide possession of Certificate No.NABET/EIA/2224/SA 0190, valid up to July 27.07.2024.

### 1.4.2 EIA Cost

EIA study was undertaken by HECS for an amount of Rs. 3, 74, 000 Lakhs. The base line monitoring was done by HECS lab, Chennai, an NABL and MoEF Accredited Laboratory.

### 1.4.3 Scope of the Study

The scope of the work mentioned includes an assessment study of Granite mining project and their impact on the region. This study puts forward the most effective ways to protect the environment from increasing pollution caused by the mining activities and recommendations for environmental-friendly development initiatives in the region.

An Environmental Impact Assessment (EIA) is an assessment of the possible impact, whether positive or negative, that a proposed project may have on the environment, together consisting of the natural, social and economic aspects, i.e., aiming at “Sustainable Development” due to the project activities.

This EIA report presents the existing baseline scenario and the assessment and evaluation of the environmental impacts that may rise during the quarry operational phases of the project. This report also highlights the Environmental Monitoring Program during the operation phase of the project and the post mined quarry management program. The generic structure of the EIA document will be as per the EIA

Notification of the MoEF&CC dated 14thSeptember 2006 and subsequent amendments. The basic structure of the report will be as under:

**Chapter 1: Introduction**

Introductory information is presented in this Chapter. The introduction chapter provides background to the project, project proponent and describes the objective of this document. The purpose and organization of the report is also presented in this chapter.

**Chapter 2: Project Description**

This Chapter includes project description and infrastructure facilities delineating all the quarry operations and environmental aspect of the granite quarry operation phase activities.

**Chapter 3: Description of the Environment**

This Chapter provides baseline environmental status of environmental components (Primary data) delineating meteorological details of the project site and surrounding area.

**Chapter 4: Anticipated Environmental Impacts & Mitigation Measures**

This Chapter presents the analysis of impacts on the environmental and social aspects of the project as a result of establishment of plan and thereby suggesting the mitigation measures.

**Chapter 5: Analysis of Alternatives (Technology and Sites)**

This chapter includes the justification for the selection of the project site from environmental point of view as well as from economic point of view.

**Chapter 6: Environmental Monitoring Program**

This chapter will include the technical aspects of monitoring, the effectiveness of mitigation measures which will include the measurement methodologies, frequency, location, data analysis, reporting schedules etc.

**Chapter 7: Additional Studies**

This chapter will detail about the Public Consultation sought regarding the project. It will also identify the risks of the project in relation to the general public and the surrounding environment during quarry operation phase and thereby presents Disaster Management Plan. Social impact assessment and R&R action plans (if any).

**Chapter 8: Project Benefits**

This chapter deals with improvement in physical and social infrastructures, employment potential and other tangible benefits.

**Chapter 9: Environmental Cost Benefit analysis**

Not recommended during scoping

**Chapter 10: Environmental Management Plan**

This is the key Chapter of the report and presents the mitigation plan, covers the institutional and monitoring requirements to implement environmental mitigation measures and to assess their adequacy during project implementation.

**Chapter 11: Summary and Conclusion**

This chapter summarizes the information given in Chapters in this EIA/EMP report and the conclusion based on the environmental study, impact identification, mitigation measures and the environmental management plan.

**Chapter 12: Disclosure of the Consultant**

Names of consultants engaged in the preparation of the EIA/EMP report along with their brief resume and nature of Consultancy rendered are included in this Chapter.

## 1.5 Objectives of the Study

- To ensure environmental considerations are explicitly addressed and incorporated into the development decision-making process.
- To anticipate and avoid, minimize or offset the adverse significant biophysical, social and other relevant effects of the above project proposal.
- To protect the productivity and capacity of natural systems and the ecological processes which maintain their respective functions
- To promote development that is sustainable and optimizes resource use as well as management opportunities.
- To fully recognize the scope and requirements of the TOR and comply with the same.
- The major objective of this study is to prepare a detailed Environmental Impact Assessment Study within the study area i.e 10 km radius from the project.

## 1.6 Methodology adopted for the Study

An Environmental Impact Assessment (EIA) is an assessment of the possible impact, whether positive or negative, that a proposed project may have on the environment, together consisting of the natural, social and economic aspects, i.e., aiming at "Sustainable Development" due to the project activities.

### 1.7 Applicable Regulatory Framework

The EIA process followed for this EIA report is composed of the following stages:

1. Study of project information.
2. Screening & Scoping.
3. Environmental pre-feasibility study & application for approval of TOR.

4. Collection of detailed project management plan/report.
5. Baseline data collection.
6. Impact identification, Prediction & Evaluation.
7. Mitigation measures & delineation of EMP.
8. Risk assessment and safety & disaster management plan.
9. Review & finalization of EIA Report based on the TOR requirements.
10. Submission of EIA report for implementation of mitigation measures & EMP as well as necessary clearances from relevant Authority.

### 1.8 Legal Complicability

The establishment and functioning of mining industry will be governed by the following environmental acts/regulations besides the local zoning and land use laws of the States.

- The Water (Prevention and Control of Pollution) Act, 1974 as amended
- The Water (Prevention and Control of Pollution) Cess Act, 1977, as amended
- The Air (Prevention and Control of Pollution) Act, 1981 as amended (Air Act).
- The Noise Pollution and Regulation Act: 2000
- The Environment (Protection) Act, 1986 (EPA)
- The Wildlife (Protection) Act, 1972 as amended
- The Forest (Conservation) Act, 1980 as amended
- The Public Liability Insurance Act, 1991
- The Mines and Minerals (Regulation and Development) Act, 1957 as amended
- Circulars issued by the Director-General Mines Safety (DGMS).
- Contract Labor Regulation and Abolition Act 1970
- The Motor Vehicles Act – 1989
- PESO – Explosives and handling of Hazardous Material: 1934.

### 1.9 Terms of Reference Compliance

The Terms of Reference (ToR) issued by SEIAA-Tamil Nadu compliance is given as follows:

**Additional ToR specified by the SEAC to deal with the violation aspects of the mining projects**

| **Additional TOR Specified by the SEAC to deal with violation aspects of the mining projects** | | |
|---|---|---|
| **Section A** | | |
| As per the MoEF & CC Notification S.O.1030 (E) dated 08.03.2018 | | |
| **S. No** | **ToR details** | **Compliance** |
| 1. | "The cases of violations will be appraised by the Expert Appraisal Committee at the Central level or | Noted. |

| | | |
|---|---|---|
| | State or Union territory level Expert Appraisal Committee constituted under sub section (3) if section 3 of the environment (Protection )Act, 1986 with a view to assess that the project has been constructed at a site which under prevailing laws is permissible and expansion has been done which can run sustainably under compliance of environmental norms with adequate environmental safeguards, and in case, where the findings of Expert Appraisal Committee for projects under category A or state or union territory level Expert Appraisal Committee for projects under category B is negative, closure of the project will be recommended along with actions under the law. | |
| 2. | In case, where the findings of the Expert Appraisal Committee or State or Union territory level Expert Appraisal Committee on point at sub-paragraph (4) above are affirmative, the projects will be granted the appropriate Terms of Reference for undertaking Environment Impact Assessment and preparation of Environment Management Plan and the Expert Appraisal Committee or State or Union territory level Expert Appraisal Committee, will prescribe specific Terms of Reference for the project on assessment of ecological damage, remediation plan and natural and community resource augmentation plan and it shall be prepared as an independent chapter in the environment impact assessment report by the accredited consultants, and the collection and analysis of data for assessment of ecological damage, preparation of remediation plan and natural and community resource augmentation plan shall be done by an environmental laboratory duly notified under the Environment (Protection) Act, 1986, or a environmental laboratory accredited by the National Accreditation board for Testing and Calibration Laboratories, or a laboratory of the council of Scientific and Industrial | Noted. |

| | | |
|---|---|---|
| | Research institute working in the field of environment." | |

After the appraisal of the project, the SEAC decided that the **Para no 2**. Stated above is applicable to the project. Hence the proponent is directed to prepare appropriate reports as contained in the **Para 2**.

While complying with the specific aspects of the MoEF & CC directions as stated in the Para 2 above, the following steps should be followed:

| S. No | ToR details | Compliance |
|---|---|---|
| **Step1: Enumerate the aspects of Violation:** | | |
| a | The proponent should enumerate the violation as applicable to the project. | Enumeration of the aspects of Violation study is conducted. The information given in **Chapter 7 and Section 7.1.2. To 7.1.6.** |
| b | Furnish a description of each violation with quantitative and qualitative data. | |
| c | Violation categories are to be decided taking into consideration the stage at which the project execution stands. | |
| **Step 2: Ecological Damage Assessment:** | | |
| a | For each aspect of violation enumerated in step (1), identify the resultant environmental damage that may have been caused. | The information given in **Chapter 7 and Section 7.1.2 To 7.1.6.** |
| b | Furnish a description of the environmental damages with quantitative and qualitative data. | |
| **Step 3: Remediation plan:** | | |
| a | For the Environmental damage (s) identified in the step (2) above, prepare the remediation plan for each or combination of damages. | Identification of Impacts and mitigation measures and Remediation plan furnished in **Chapter 7 and Section 7.1.4 To 7.1.6.** |
| b | The remediation plan should essentially consists of problem statement, target to be achieved (quantity), standards, technology/procedure for remediation, equipment and machinery to be used, time schedule and remediation cost (direct and indirect cost, capital as well as O & M costs). | |
| **Section B** | | |
| 1 | **Natural resource Augmentation** | |
| a | The resource that should be considered for augmentation should essentially consist of land, biota, air water and other resources as applicable. | The information about Natural resources augmentation Plan furnished in **Chapter 7** and **Section 7.1.5 to 7.1.6.** |
| b | Proponent may choose one or more of the resource augmentation as applicable and provide a description of the augmentation | |

| S. No | ToR details | Compliance |
|---|---|---|
| **Step1: Enumerate the aspects of Violation:** | | |
| | proposal in details for each resource. | |
| c | The proponent should also furnish the cost for each augmentation scheme. | |
| 2 | **Community resource Augmentation** | |
| a | The proponent should prepare a plan of action for addressing the needs of the community in terms of resources in the sectors of education, health and sports primarily and other such resources as applicable to the community in the vicinity of the project. | The information about Community augmentation Plan furnished in **Chapter 7** and **Section 7.1.6** |
| b | The community resource augmentation plan should consist of rehabilitation of house and people, budget allocation and time schedule for completing the activity. | |
| | **Section C** | |
| Section C | The proponent should prepare content for the ecological damage assessment, remediation plan, natural resource augmentation and community resource augmentation separately in a chapter and include in the EIA/EMP Report. | Ecological damage assessment, remediation plan, natural resource augmentation and community resource augmentation are prepared as separate **Chapter 7** Sections **7.1.2** to **Section 7.1.6.** |
| | **Section D** | |
| a | After the appraisal of the EIA/EMP report submitted by the proponent, SEAC will make a judgment of the quality of the content in the EIA/EMP report specifically with reference to the chapter covering the ecological damage assessment, remediation plan, natural resource augmentation and community resource augmentation. | EIA Prepared as per ToR and enclosed the Ecological damage assessment, remediation plan, natural resource augmentation and community resource augmentation are prepared as a separate **Chapter 7 Section 7.1.2** to**Section 7.1.6** |
| b | In the judgement of SEAC, if the quality of the content in the chapter is not satisfactory, the SEAC may direct the proponent to further revise the chapter and resubmit the EIA/EMP report. | EIA Prepared as per ToR and enclosed the Ecological damage assessment, remediation plan, natural resource augmentation and community resource augmentation are prepared as a separate **Chapter 7 Section 7.1.2** to **Section 7.1.6** |
| c | If SEAC concludes that the technical part is satisfactory and the costing aspect is not satisfactory then the SEAC may revert to legal provisions, MoEF & CC guidelines and similar expert committee recommendations for finalizing the | EIA Prepared as per generic structure prescribed in **Appendix –III** of EIA Notification 2006 and covered all ToR Compliance. |

| S. No | ToR details | Compliance |
|---|---|---|
| **Step1: Enumerate the aspects of Violation:** | | |
| | cost aspects or the SEAC may use its own expertise and experience in finalizing the cost. | |
| | **Section E** | |
| Section E | The proponent is directed to furnish data as per the questionnaire appended in Annexure I. It will help the SEAC in arriving the ecological damage and the associated cost. | Noted. |
| | **Section F** | |
| Section F | In compliance with the Supreme Court order stated in MoEF & CC letter F.No. 3-50/2017 IA.III-pt dated 05th January 2018, the proponent is required to submit the No Objection certificate obtained from the Department of Geology and Mining, Government of Tamil Nadu regarding payment of 100% cost of illegally mined mineral under section 21(5) of MMDR Act 1957 which would account for mining operation in violation of the following: | No Objection certificate obtained from the Department of Geology and Mining is attached as **Annexure-3** |
| a | Without Environment Clearance (EC) Or in excess of the quantity approved in EC. | Mining lease is obtained for 20 years from 2007 to 2027. The mine was operated without prior EC as per EIA Notification 2006.The production details are provided in **Chapter 2 and Section 2.7.** |
| b | Without Consent of Operate (CTO) or in excess of the quality approved in CTO. | No Consent of Operate (CTO). |
| c | Without mining plan/scheme of mining or in excess of the quantity approved in mining plan/scheme of mining. | The Scheme of Mining -I was approved by the Commissioner of Geology & mining, Chennai vide letter No. 18349/MM5/2008, dated 10.07.2009.<br><br>The Scheme of Mining -II for the period from 2013-2014 to 2017-2018 was prepared with 10% recovery and the same was submitted for the approval vide TAMIN letter No. Date15738/ML2/2013, d 03.11.2015<br><br>The SOM-II was approved by the Commissioner of Geology & mining, Chennai vide letter No. Rc.No.15738/ML2/2013, dated 03.11.2015<br><br>The SOM-III was approved by the Commissioner of Geology & mining, Chennai vide letter No. Rc.No.5167/MM4/2020, dated 16.12.2020 |

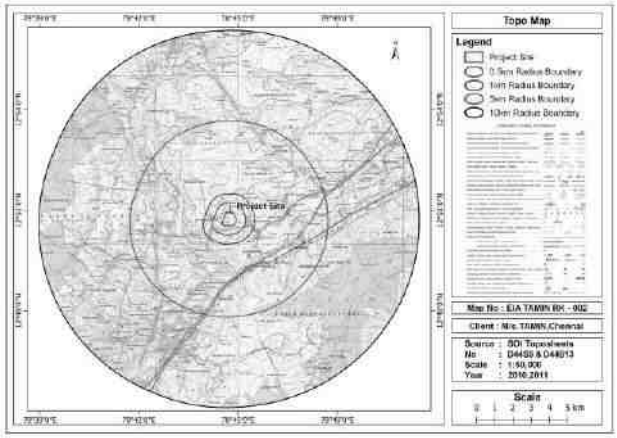
<table>
<tr><th>S. No</th><th>ToR details</th><th>Compliance</th></tr>
<tr><td colspan="3">Step1: Enumerate the aspects of Violation:</td></tr>
<tr><td></td><td></td><td>The production details given in Chapter 2. Section 2.7.</td></tr>
<tr><td>d</td><td>Without Forest Clearance.</td><td>Not Applicable</td></tr>
<tr><td>e</td><td>Any other violation.</td><td>Quarry is in operation from 2003 to 2013 without Environmental Clearance (EC), thus though this project comes under violation category as per MoEF&CC Violation notification vide S. No. 804 (E) dated 14th March, 2017.</td></tr>
<tr><td>f</td><td>List out the details of reserve forest and wild life sanctuary nearby the project site (the details should also include other districts which are nearby the project site and reserve forest/wildlife sanctuary.</td><td><u>Reserve Forests</u>
<table>
<tr><th>S.No</th><th>Reserve Forests</th><th>Distance (km)</th><th>Direction</th></tr>
<tr><td>1</td><td>Pallalakuppam RF</td><td>0.64</td><td>NW</td></tr>
<tr><td>2</td><td>Sanankuppam RF</td><td>2.48</td><td>SSE</td></tr>
<tr><td>3</td><td>Amburdrug RF</td><td>4.05</td><td>W</td></tr>
<tr><td>4</td><td>Ambur RF</td><td>4.57</td><td>S</td></tr>
<tr><td>5</td><td>Charagallu RF</td><td>4.92</td><td>WNW</td></tr>
<tr><td>6</td><td>Pallalakuppam Extension RF</td><td>5.04</td><td>NE</td></tr>
<tr><td>7</td><td>Pallalakuppam Extension RF</td><td>5.69</td><td>N</td></tr>
<tr><td>8</td><td>Kempasamudram RF</td><td>6.30</td><td>WNW</td></tr>
<tr><td>9</td><td>Karappattu RF</td><td>9.39</td><td>WSW</td></tr>
<tr><td>10</td><td>Gundlapalli RF</td><td>9.70</td><td>N</td></tr>
<tr><td>11</td><td>Mordana Extension RF</td><td>10.45</td><td>NNW</td></tr>
<tr><td>12</td><td>Nayakkaneri Extension RF</td><td>10.98</td><td>NW</td></tr>
<tr><td>13</td><td>Karuttamalai RF</td><td>13.29</td><td>SE</td></tr>
</table>
Wildlife Sanctuary: Koundinya WLS ESZ ~ 13.18km, NW<br><br>The details of environmental sensitive areas covering within 15 km from project boundary are given in Chapter 3 and Section 3.4</td></tr>
<tr><td>g</td><td>Whether the project site attracts HACA clearance? If so, also furnish the HACA clearance for the mining from the competent authority.</td><td>Project site does not attract the HACA clearance</td></tr>
<tr><td>h</td><td>The proponent is instructed to fill in the form contained in Annexure I to work out the details of the ecological damage during the violation period.</td><td>The details of the ecological damage during the violation period are discussed in Chapter 7, Section 7.1.4, and Table 7.6.<br>Ecological Damage due to mining Activities & Remediation Plan and Cost is Rs.10,40,279.6/-<br>Natural Augmentation Cost is Rs.3,00,00/-</td></tr>
</table>

| S. No | ToR details | Compliance |
|---|---|---|
| **Step1: Enumerate the aspects of Violation:** | | |
| | | Community Augmentation Cost is Rs.2,00,000/- |

**STANDARD TERMS OF REFERENCE**

| S. No | ToR Point | Compliance |
|---|---|---|
| 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 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. | 20 years of Quarry lease period is from 03.09.2007-16.09.2027.<br>The Information given in **Chapter 1,** Mining lease GO enclosed as **Annexure –I.**<br>The production details are provided in **Chapter 2, Section 2.7.Table 2-9 to Table 2.11.** |
| 2. | A copy of the document in support of the fact that the Proponent is the rightful lessee of the mine should be given. | Mining lease document is enclosed as **Annexure –I.** |
| 3. | All documents including approved mine plan, EIA and Public Hearing should be compatible with one another in terms of the mines lease area, production levels, waste generation and its management, mining technology etc. and should be in the name of the lessee. | Noted, All Mining Plan, EIA & Lease obtained on Tamil Nadu Minerals Limited only. |
| 4. | All corners co-ordinates of the mine lease area, superimposed on a High Resolution Imagery/ toposheets, topographic sheets, 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). | |

| S.No | Latitude | Longitude |
|---|---|---|
| TM1 | 12°50'56.61" | 78°44'38.90" |
| TM2 | 12°50'54.91" | 78°44'50.10" |
| TM3 | 12°50'57.05" | 78°44'50.45" |
| TM4 | 12°50'48.27" | 78°44'55.73" |
| TM5 | 12°50'48.27" | 78°44'54.90" |
| TM6 | 12°50'45.59" | 78°44'56.98" |
| TM7 | 12°50'39.54" | 78°44'56.70" |
| TM8 | 12°50'39.30" | 78°44'57.16" |
| TM9 | 12°50'36.76" | 78°44'55.35" |
| TM10 | 12°50'33.47" | 78°44'51.31" |
| TM11 | 12°50'33.13" | 78°44'49.89" |
| TM12 | 12°50'33.03" | 78°44'46.03" |
| TM13 | 12°50'32.39" | 78°44'44.01" |
| TM14 | 12°50'32.28" | 78°44'43.11" |
| TM15 | 12°50'33.64" | 78°44'42.80" |
| TM16 | 12°50'33.10" | 78°44'37.96" |

| | | |
|---|---|---|
| | | TM17 \| 12°50'31.84" \| 78°44'37.86"<br>TM18 \| 12°50'34.69" \| 78°44'35.35"<br>TM19 \| 12°50'35.30" \| 78°44'29.62"<br><br>All corners co-ordinates of the mine lease area are given in **Chapter 1**, **Section 1.4.3 &Table 1-1.** |
| 5. | Information should be provided in Survey of India Toposheets 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. | Topo map prepared in 1:50000 scale and given as **Figure 3-2** in **Chapter 3.**<br>  |
| 6. | Details about the land proposed for mining activities should be given with information as to whether mining confirms 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 Information given in **Chapter- 1, Section 1.2** & Mining lease enclosed as **Annexure –I.**<br>The production details are provided in **Chapter 2, Section 2.6 & Section 2.7, Table 2.9 to 2.11.** |
| 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 environment or forest norms/condition? The hierarchical system or administrative order of the company to deal with the environmental issues and for ensuring compliance with the EC | Noted |

| | | |
|---|---|---|
| | conditions may also be given. The system of reporting of non-compliance/ 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. | |
| 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. | Open cast, semi-mechanized mining with 6m vertical bench with a bench width of 6m has been proposed.<br>Mining methodology is provided in **Chapter 2** and **Section 2.9.** |
| 9. | The study area will comprise of 10km zone around the mine lease from lease periphery and the data contained in the EIA such as waste generation etc. should be for the life of the mine/lease period. | Noted.<br>The study area of 10km zone around the mines lease from lease periphery and furnished in **Chapter 3.** |
| 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 pattern is given in **Chapter 3** and **Section 3.5.4, Figure 3-4, Figure3-5, Table3-2, Table 3-3, Figure 3-7 & Figure 3-8.** |
| 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. | Land use pattern is given in **Chapter 3** and **Section 3.5.4, Figure 3-4, Figure3-5, Table3-2, Table 3-3, Figure 3-7 & Figure 3-8.** Over burden disposed within the lease area photo is give in **Figure 2-9** |
| 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 | There was no forestry clearance for the broken up area and virgin forest land involved in the project.<br><br>PallalakuppamRF,0.64km,NW<br>Sanankuppam RF, 2.48km, SSE<br>Amburdrug RF, 4.05km, W<br>Ambur RF, 4.57km, S<br>Charagallu RF, 4.92km, WNW<br>. |

| | | |
|---|---|---|
| | Regional Office of the Ministry of 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. | |
| 13. | Status of forestry clearance for the broken up area and virgin forest land involved in the project including deposition of Net Present Value (NPV) & Compensatory Afforestation (CA) should be indicated. A copy of the forest clearance should also be furnished. | There was no forestry clearance for the broken up area and virgin forest land involved in the project.<br><br>The following forest are there in the site within 5 km radius:<br>1. Pallalakuppam RF,0.64km, NW<br>2. Sanankuppam RF, 2.48km, SSE<br>3. Amburdrug RF, 4.05km, W<br>4. Ambur RF, 4.57km, S<br>5. Charagallu RF, 4.92km, WNW<br>. |
| 14. | Implementation status of recognition of forest right under the Scheduled Tribes and other Traditional Forest Dwellers (Recognition of Forest Rights) Acts, 2006 should be indicated. | Not applicable.<br>No scheduled tribes and other traditional forest dwellers are observed. |
| 15. | The vegetation in the RF/PF areas in the study area, with necessary details, should be given. | The details of environmental sensitive areas & Reserve forests covering within 15 km from project boundary are given in **Chapter 3** and **Section 3.4 & Table 3-1.** |
| 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 mitigate measures required, should be worked out with cost implications and submitted. | Detailed mitigate measures are furnished in **Chapter 4.** |
| 17. | Location of National Parks, Sanctuaries, Biosphere Reserves, wildlife Corridors, Ramsar site Tiger/Elephant Reserves (existing as well as proposed), if any, within 10km of the mines 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 | The details of environmental sensitive areas covering within 15 km from project boundary are given in **Chapter 3** and **Section 3.4. & Table 3-1.** |

| | | |
|---|---|---|
| | obtained from the standing committee of National Board of Wildlife and copy furnished. | |
| 18. | A detailed biological study area [core zone and buffer (10km radius of the periphery of the mines lease)] shall be carried out. Details of the 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. | Details of the flora and fauna, endangered, endemic and RET species for core and buffer zone is given in **Chapter 3** and **Section 3.11.**<br><br>There is one scheduled I species isfound in the study area, the conservation plan is prepared and given in **Chapter 3, Section 3.11.13.** |
| 19. | Proximity to areas declared as 'Critically Polluted' or the project areas likely to come under the 'Aravali 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. | There is no critical polluted area within 15km radius of the project site. |
| 20. | Similarly, for coastal projects, a CRZ map duly authenticated by one of the authorized agencies demarcating LTL, HTL, CRZ area, location of the mines 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). | There is no Coastal Zone within 15km radius of the project site. |
| 21. | R&R Plan/compensation details for the Project Affected People (PAP) should be furnished. While | There is no Rehabilitation and resettlement is involved. Land classified as a Government poramboke land. Mining lease obtained dated 11.11.2011 from Govt. of Tamil Nadu for 30 |

| | | |
|---|---|---|
| | preparing the R&R plan, the relevant State/National Rehabilitation & Resettlement Policy should be kept in view. In respect of SC's/ST's 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 their action programmes prepared and submitted accordingly, integrating the sectoral programmes of the line departments of the State Government. It may be clearly brought out whether the village(s) located in the mine lease 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. | years. Validity up to 15.02.2042. |
| 22. | One season (non monsoon) i.e. March-May (summer season), October-December (post monsoon season), December-February (Winter season) primary baseline data on ambient air quality as per CPCB notification of 2009, water quality, noise level, soil and flora and fauna shall be collected and the AAQ and other data so complied 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 500m of the mine lease in the pre-dominant downwind direction. The mineralogical composition of $PM_{10}$, particularly for free silica, should be given. | The primary baseline data monitored covered three (3) months i.e., from **Mid of Jan 2023 – Mid of April 2023**, and secondary data was collected from Government and Semi-Government organizations. The primary baseline data results and discussion furnished in **Chapter 3.** |
| 23. | Air quality modeling should be carried out for prediction of | |

<table>
<tr>
<td></td>
<td>impacts of the project on the air quality of the area. It should also take into account the impact of the movement of vehicles for transportation of minerals. The details of the model used and input parameters used for modeling should be provided. The air quality contours may be shown on allocation 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 be also indicated on the map.</td>
<td>
<table>
<tr><th>Pollutant</th><th>Max. Base Line Conc. (µg/m$^3$)</th><th>Estimated Incremental Conc. (µg/m$^3$)</th><th>Total Conc. (µg/m$^3$)</th><th>NAAQ standard</th><th>% contribution of concentration above Base line</th></tr>
<tr><td>TSPM</td><td>171</td><td>2.34</td><td>173.34</td><td>500</td><td>1.37</td></tr>
<tr><td>$PM_{10}$</td><td>68.4</td><td>0.51</td><td>68.91</td><td>100</td><td>0.75</td></tr>
<tr><td>$PM_{2.5}$</td><td>30.7</td><td>0.30</td><td>31</td><td>60</td><td>0.98</td></tr>
<tr><td>$SO_2$</td><td>10.2</td><td>0.11</td><td>10.31</td><td>80</td><td>1.08</td></tr>
<tr><td>$NO_X$</td><td>23.6</td><td>1.08</td><td>24.68</td><td>80</td><td>4.58</td></tr>
</table>
Air quality modeling carried out for prediction of impacts of the project on the air quality of the area. The details are given in Chapter 4 and Section 4.2.1.2 & 4.2.1.3.
</td>
</tr>
<tr>
<td>24.</td>
<td>The water requirement for the project, its availability and sources should be furnished. A detailed water balance should be provided. Fresh water requirement for the project should be indicated.</td>
<td>
<table>
<tr><th>S. No</th><th>Description</th><th>Water Requirement(KLD)</th></tr>
<tr><td>1.</td><td>Drinking water</td><td>0.2</td></tr>
<tr><td>2.</td><td>Flushing</td><td>1.3</td></tr>
<tr><td>3.</td><td>Dust suppression</td><td>10.8</td></tr>
<tr><td>4.</td><td>Green belt</td><td>12.3</td></tr>
<tr><td colspan="2">Total</td><td>24.6</td></tr>
</table>
The water requirement for the project is 25.0 KLD and breakup is addressed in Chapter 2 and Section 2.10.2 & Table 2-14.
</td>
</tr>
<tr>
<td>25.</td>
<td>Necessary clearance from the Competent Authority for drawl of requisite quantity of water for the project should be provided.</td>
<td>No ground water withdrawn to met the water requirement. The total water requirement is sourced from Private tank suppliers.</td>
</tr>
<tr>
<td>26.</td>
<td>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.</td>
<td>
Surface Water Pollution Control Measures
<ul>
<li>Construction of garland drains of suitable size around mine area and dumps to prevent rain water descent into active mine areas.</li>
<li>During monsoon season, the rain water is being collected by natural slope of area to water fed tank of the mine and it will be utilized for dust suppression and greenbelt development.</li>
<li>The mine water will be regularly tested for presence of any undesirable elements and appropriate measures will be taken in case any element is found exceeding the limits prescribed by CPCB.</li>
</ul>
Ground Water Pollution Control Measures
<ul>
<li>The domestic sewage from the canteen and toilets will be routed to septic tanks.</li>
<li>Regular monitoring of water levels and quality in the existing open wells and bore well in the vicinity will be carried out.</li>
</ul>
</td>
</tr>
</table>

| | | |
|---|---|---|
| | | **Rain Water Harvesting**<br>➢ The rainwater is being diverted towards the middle of the mine to prevent water entering the mine working. The rainwater flows will also contain fines both from surface and waste dumps during seasonal flows. As such, it is being proposed to have structures in such a way to act as settling pond and also for rainwater harvesting.<br><br>Water conservation measures are proposed in **Chapter 4** and **Section 4.4.2 & Section 4.4.3.** |
| 27. | Impact of the project on the water quality, both surface and ground water, should be assessed and necessary safeguard measures, if any required, should be provided. | Impacts on water environment & water conservation measures are proposed in **Chapter 4 Section 4.4**. |
| 28. | Based on actual monitored data, it may clearly be shown whether working will intersect ground water. Necessary data and documentation in this regard may be provided. In case the working will intersect ground water 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 groundwater should also be obtained and copy furnished. | The mining activity proposed in depth of 30m from top of the hillock as per mining Plan.<br><br>Water table is found at a depth of 15m below ground level as per mining Plan.<br><br>Water requirement is met through private water supply. There is no withdrawl of ground water. |
| 29. | Details of any stream, seasonal or otherwise, passing through the lease area and modification/diversion proposed, if any, and the impacts of the same on the hydrology should be brought out. | Nil |
| 30. | Information on site elevation, working depth, groundwater table etc. should be provided both in AMSL and bgl. A scientific diagram may also be provided for the same. | Site Salient features are given in **Chapter 2** and **Section 2.4, Table 2-1.** |
| 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 | Green Belt Development plan is proposed for 0.06.5Ha. Details given in **Chapter 4**, **Section 4.11** & Green belt photos are given in **Figure 2-8.** |

| | | |
|---|---|---|
| | submitted, keeping in mind, the same will have to be executed up front on commencement of the project. Phase-wise plan of plantation already done should be given. The plant species selected for greenbelt should have greater ecological value and should be of good utility value to local population with emphasis on local and native species and the species which are tolerant to pollution. | |
| 32. | Impact on local transport infrastructure due to the project should be indicated. Projected increase in truck traffic as a result of the project in the present road network (including those outside the project area) should be worked out, indicating whether it is capable of handling the incremental load. Arrangement for improving the infrastructure, if contemplated (including action to be taken by other agencies such as state government) should be covered. Project proponent shall conduct impact of Transportation study as per Indian Road Congress Guidelines. | The Granite dimensional blocks are transported to consumer directly as per buyer's requirement. The granite is being transported through existing road by tippers and approximate number of trips required is 2 times per week. This minimum trip does not create impact on existing transportation.<br><br>Impacts and mitigation measures on transportation is given in **Chapter 4, Section 4.3.** |
| 33. | Details of the onsite shelter and facilities to be provided to the mines workers should be included in the EIA Report. | Sanitation facilities are provided to employees |
| 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. | Conceptual post mining land use and Reclamation and restoration sectional plates are given in Mining Plan followed by Scheme of mining. |

<table>
<tr><td>35.</td><td>Occupational Health impacts of the project should be anticipated and the proposed preventive measures spelt out in detail. Details of pre-placement medical examination and periodical medical examination schedules should be incorporated in the EMP. The project specific occupational health mitigation measures with required facilities proposed in the mining area may be detailed.</td><td>Occupational Health impacts &preventive measures detail given in Chapter 4 and Section 4.12.<br><br><table><tr><th>S. No</th><th>EMP</th><th>Cost</th></tr><tr><td>1.</td><td>Afforestation</td><td>30,000/-</td></tr><tr><td>2.</td><td>Water Sprinkling</td><td>50,000/-</td></tr><tr><td>3.</td><td>Water Quality Test</td><td>25,000/-</td></tr><tr><td>4.</td><td>Air Quality Test</td><td>25,000/-</td></tr><tr><td>5.</td><td>Noise/Vibration Test</td><td>25,000/-</td></tr><tr><td>6.</td><td>CSR activities</td><td>50,000/-</td></tr><tr><td colspan="2">Total</td><td>2,05,000/-</td></tr></table>The EMP details are given as separately as Chapter 10 along with EMP Cost details.</td></tr>
<tr><td>36.</td><td>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.</td><td>Occupational Health impacts &preventive measures detail given in Chapter 4 and Section 4.12.<br>The EMP details are given as a separately as Chapter 10 along with EMP Cost details.</td></tr>
<tr><td>37.</td><td>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.</td><td>Impacts and measures are addressed in Chapter 4 and Section 4.13.</td></tr>
<tr><td>38.</td><td>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.</td><td>The EMP details are given as a separately as Chapter 10 along with EMP Cost details.</td></tr>
</table>

<table>
<tr><td>39.</td><td>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.</td><td>The proposed project is categorized ‘B’ category as per EIA Notification 2006; As per MoEF & CC Office Memorandum, dated 3rdJune 2009; EIA Notification, 2006 exempted from undertaking public hearing in existing projects.<br>However, the proposed project falls under violation category, Public Hearing is Mandatory for violation projects. So, EIA report has been prepared as per the obtained violation ToR vide. F. No. SEIAA-TN/F.No. 1652/SEAC/ToR -1343/2023 dated 16.02.2023. Draft EIA report will be submitted for Public Hearing (PH). After PH the minutes was incorporated in the EIA report along with action plan or commitment by the proponent. Final EIA will be submitted to TNSEAC for further appraisal of the project and obtaining Environment Clearance.</td></tr>
<tr><td>40.</td><td>Details of litigation pending against the project, if any, with direction/order passed by any Court of Law against the project should be given.</td><td>There is no litigation pending against the project.<br>But, TAMIN has started the quarry activites without prior EC, the project falls under Violation category.</td></tr>
<tr><td>41.</td><td>The cost of the project (capital cost and recurring cost) as well as the cost towards implementation of EMP should be clearly spelt out.</td><td>The project Cost is addressed in Chapter 2 and Section 2.8.
<table>
<tr><th>S. No</th><th>Description of the Cost</th><th>Cost in Lakhs</th></tr>
<tr><td colspan="3">I. Fixed Asset Cost</td></tr>
<tr><td rowspan="4">1</td><td>Land Cost</td><td>Nil because of Govt. Land</td></tr>
<tr><td>Labours Shed</td><td>50,000/-</td></tr>
<tr><td>Sanitary facilities</td><td>50,000/-</td></tr>
<tr><td>Fencing Cost</td><td>1,25,000/-</td></tr>
<tr><td></td><td>Sub Total</td><td>2,25,000/-</td></tr>
<tr><td colspan="3">II. Operational cost</td></tr>
<tr><td rowspan="8"></td><td>Jack Hammers (6 nos)</td><td>1,98,000/-</td></tr>
<tr><td>Compressor (2 nos)</td><td>19,82,000/-</td></tr>
<tr><td>Diamond wire sa (1 no)</td><td>4,87,000/-</td></tr>
<tr><td>Diesel General 120KVA</td><td>4,00,000/-</td></tr>
<tr><td>Excavator (1 no). hire</td><td>6,00,000/-</td></tr>
<tr><td>Tippers (2 nos)</td><td>58,00,000/-</td></tr>
<tr><td>Drinking water facility for the labours</td><td>50,000/-</td></tr>
<tr><td>Safety kits</td><td>50,000/-</td></tr>
<tr><td></td><td>Sub Total</td><td>95,67,000/-</td></tr>
<tr><td>III</td><td>EMP Cost</td><td></td></tr>
<tr><td rowspan="7"></td><td>Afforestation</td><td>30,000/-</td></tr>
<tr><td>Water Sprinkling</td><td>50,000/-</td></tr>
<tr><td>Water Quality Test</td><td>25,000/-</td></tr>
<tr><td>Air Quality Test</td><td>25,000/-</td></tr>
<tr><td>Noise/Vibration Test</td><td>25,000/-</td></tr>
<tr><td>CSR activities</td><td>50,000/-</td></tr>
<tr><td></td><td>Sub Total</td><td>2,05,000/-</td></tr>
<tr><td colspan="2">Grand Total</td><td>99,97,000/-</td></tr>
</table></td></tr>
</table>

| | | |
|---|---|---|
| | | ≃Rs.1 Crore |
| 42. | A Disaster management Plan shall be prepared and included in the EIA/EMP report. | Disaster Management Plan is given in **Chapter 7** and **Section 7.1.7.** |
| 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. | **The project benefits are:**<br>➢ The quarrying activities in this belt will benefit to the local people both directly 35 and indirectly 20 persons.<br>➢ The direct beneficiaries will be those who get employed in the mines as skilled and unskilled workers.<br>➢ Improvement in Per Capita Income.<br>➢ The socio - Economic conditions of the village and distance will enhance due to the project, hence the project should be allowed after considering all the parameters.<br>➢ It can thus be concluded that the project is environmentally compatible, financially viable and would be in the interest of construction industry thereby indirectly benefiting the masses.<br>Project benefits are given in **Chapter 8.** |
| 44. | Besides the above, the below mentioned general points are also to be followed: | |
| a) | Executive Summary of the EIA/EMP report. | Executive Summary of EIA Report is given as separate book let. |
| b) | All documents to be properly referenced with index and continuous page numbering. | All documents addressed with properly referenced with index and continuous page numbers. |
| 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. | Yes, sources for all tables are addressed. |
| d) | Project Proponent shall enclose all the analysis/testing reports of Water, Soil, Air, Noise etc. using the MoEF&CC/NABL accredited laboratories. All the original analysis/testing reports should be available during appraisal of the Project. | All the analysis/testing reports of Water, Soil, Air, Noise etc. are conducted by MoEF&CC &NABL accredited laboratories. The disclosure of Consultant is given in **Chapter 12.** |
| e) | Where the documents provided are in a language other than English, an English translation should be provided. | The total document is prepared in English only. |
| f) | The Questionnaire for environmental appraisal of mining projects as devised earlier by the ministry shall also be filled and submitted. | SEIAA-TN additional information for considering EC for mining projects Annexure –I will be provided in Final EIA report**.** |
| g) | While preparing the EIA report, the instructions for the | Yes, EIA Prepared as per generic structure prescribed in **Appendix –III** of EIA Notification 2006 and covered the all |

| | | |
|---|---|---|
| | 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. | ToR Compliance. |
| h) | Changes if any made in the basic scope and project parameters (as submitted in Form-I and the PFR for securing the TOR) should be brought to the attention of MoEF&CC with reasons for such changes and permission should be sought, as the TOR may also have to be altered. Post Public Hearing changes in structure and content of the draft EIA/EMP (other than modifications arising out of the P.H process) will entail conducting the PH again with the revised documentation. | There are no Changes in prepared EIA as per submitted Form-I and PFR. |
| 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 condition 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. | As TAMIN has started the quarry activites without prior EC, the project falls under Violation category. |
| 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. | All Sectional Plates of Quarry are given in Revised Modified Scheme of Mining –I in **Annexure -III.** |

**In addition to the above the following shall be furnished:**
**The executive summary of the EIA/EMP report in about 8-10 pages should be prepared incorporating the information on the following point:**

| S. No | ToR Point | Compliance |
|---|---|---|
| 1. | Project name and location (Village, District, State, Industrial Estate (if applicable). | Noted |
| 2. | Products and capacities. If expansion proposal then existing products with capacities and | Noted |

| | | |
|---|---|---|
| | reference to earlier EC. | |
| 3. | Requirement of land, raw materials, water, power, fuel, with source of supply (Quantitative). | Noted |
| 4. | Process description in brief, specifically indicating the gaseous emission, liquid effluent and solid and hazardous wastes. | Noted |
| 5. | Measures for mitigation the impacts on the environment and mode of discharge or disposal. | Noted |
| 6. | Capital cost of the project, estimated time of completion. | Noted |
| 7. | Site selected for the project- Nature of land-Agricultural (single/double crop), barren, Govt/private land, status of/is acquisition, nearby (2-3kms) water body, population. Within 10km other industries, forest, eco sensitive zone, accessibility, (note in case of industrial estate this information may not be necessary). | Noted |
| 8. | Baseline environmental data-air quality, surface and ground water quality and soil characteristic, flora and fauna, socio economic conditions of the nearby population. | Noted |
| 9. | Identification of hazards in handling, processing and storage of hazardous material and safety system provided to mitigate the risk. | Noted |
| 10. | Likely impact of the project on Air, Water, Land, flora and fauna and nearby population. | Noted |
| 11. | Emergency preparedness plan in case of natural or in case of plant emergencies. | Noted |
| 12. | Issues raised during public hearing (if applicable) and response giving. | Noted |
| 13. | CER plan with proposed expenditure. | Noted |
| 14. | Occupational Health Measures. | Noted |
| 15. | Post project monitoring plan. | Noted |

**Besides the above the below mentioned general points should also be followed:**

| S. No | ToR Point | Compliance |
|---|---|---|
| a. | A note containing compliance of the ToR with cross referencing of the relevant sections/pages of the EIA report should be provided. | Noted |
| b. | All documents mat be properly referenced with index, page number and continuous page numbering. | Noted |
| c. | Copy of permission related to port facility, desalination plant, wind mill/solar power plant from competent Authority. | No, Not applicable to project. |
| d. | Where data are present in the report especially in table, the period in which the data where were collected and the sources should be indicated. | Noted |
| e. | While preparing the EIA report, the instructions for the proponents and instruction for the consultant issued by the MoEF vide OM no. J-11013/41/2006-IA.II(I) dated 4th August 2009 which are available on the website of the ministry should also be followed. | Noted |
| f. | The consultants involved in the preparation of EIA/EMP report after accreditation with quality council of India (QCI)/National Accreditation board of Education and Training (NABET) would need to include a certificate in this regard in the EIA/EMP reports prepared by them and data provided by other organizations/laboratories including the status of the approvals etc. in this regards circular no. F.No.J-11013/77/2004-IA-II(I) dated 2nd December, 2009, 18th March 2010 , 28th may 2010, 28th June 2010, 31st December 2010 and 30th September 2011 posted on the Ministry's website http://www/moef.nic.in/ may be referred. | Noted |

After preparing the EIA (as per the generic structure prescribed in Appendix III of the EIA notification 2006) covering the above mentioned points, the proponent will take necessary action for obtaining environmental clearance in accordance with the procedure prescribed under the EIA notification 2006.

- The final EIA report shall be submitted to the SEIAA, Tamil Nadu for obtaining Environmental Clearance.
- The ToR's prescribed shall be valid for a period of 3 years from the date of issue for the submission of the EIA/EMP report as per O. M No. J-11013/41/2006/IA-II(I) (part) dated 29th August 2017. The receipt of this letter may be acknowledged.

# 2 PROJECT DESCRIPTION

## 2.1 Type of project including interlinked and interdependent projects

The colour granite quarrying operation is proposed to carry out by opencast semi mechanized method by formation of benches. Benches are proposed with a height of 6m & width bench not less than the height. The area applied for quarry lease is exhibits hilly terrain; the altitude of the area is above ~440m AMSL. Total Geological Reserves in the area is 1,34,44,860$m^3$, and the Updated Geological Reserves as on 31.03.2018 is 1,33,62,730 $m^{3,}$ & Total Updated Mineable Reserves is 1,15,39,845 $m^3$ and the Updated Mineable Reserves as on 31.03.2018 is 1,14,57,715$m^{3,}$ .

### 2.1.1 Need for the Project

The colour granite dimensional stone material by virtue of its pleasing color and texture such as and its best ability to take polishing and appealing look in polished product has attracted the consumers in the building construction and interior decoration industries. The domestic market capabilities have also been explored in recent periods. Bulk quantity of the blocks is produced and exported as raw blocks and some quantity is being processed at TAMIN's Granite processing units and exported as value added finished products.

Mineral Industries of the state of Tamil Nadu provides employment opportunities for the people of the state as well as in the specific project area. The Quarrying is one among the major core sector for industries, which plays a vital process of country's economic development.

### 2.1.2 Quarry Location

The colour granite mine is over an extent of 46.07.0 ha located in S.F.No.311 (Part), located at Rajakkal Village, Pernambut Taluk (erstwhile Gudiyatham Taluk), Vellore District, lies in the latitude of 12°50'28.48" N to 12°50'54.66" N and longitude of 78°44'28.52" E to 78°44'55.84" E. The area is marked in the survey of India Topo sheet No.57L/9 and 57L/13. Site Elevation is above ~440m AMSL. The boundary Coordinates of the site given in **Table 2.1.** The project location map is given in **Figure 2.1.** Google Imagery of the lease area boundary is given in **Figure 2.2.** 300 m & 500m Radius Google Imagery of the project site is given in **Figure 2.3**. 10km radius village map of the project site is shown in **Figure 2.4**. Topo map of the study area is given in **Figure 2.5.** Environmental sensitive areas covering within 15 km from project boundary is given in **Figure 2.6** & **Figure 2.7**.

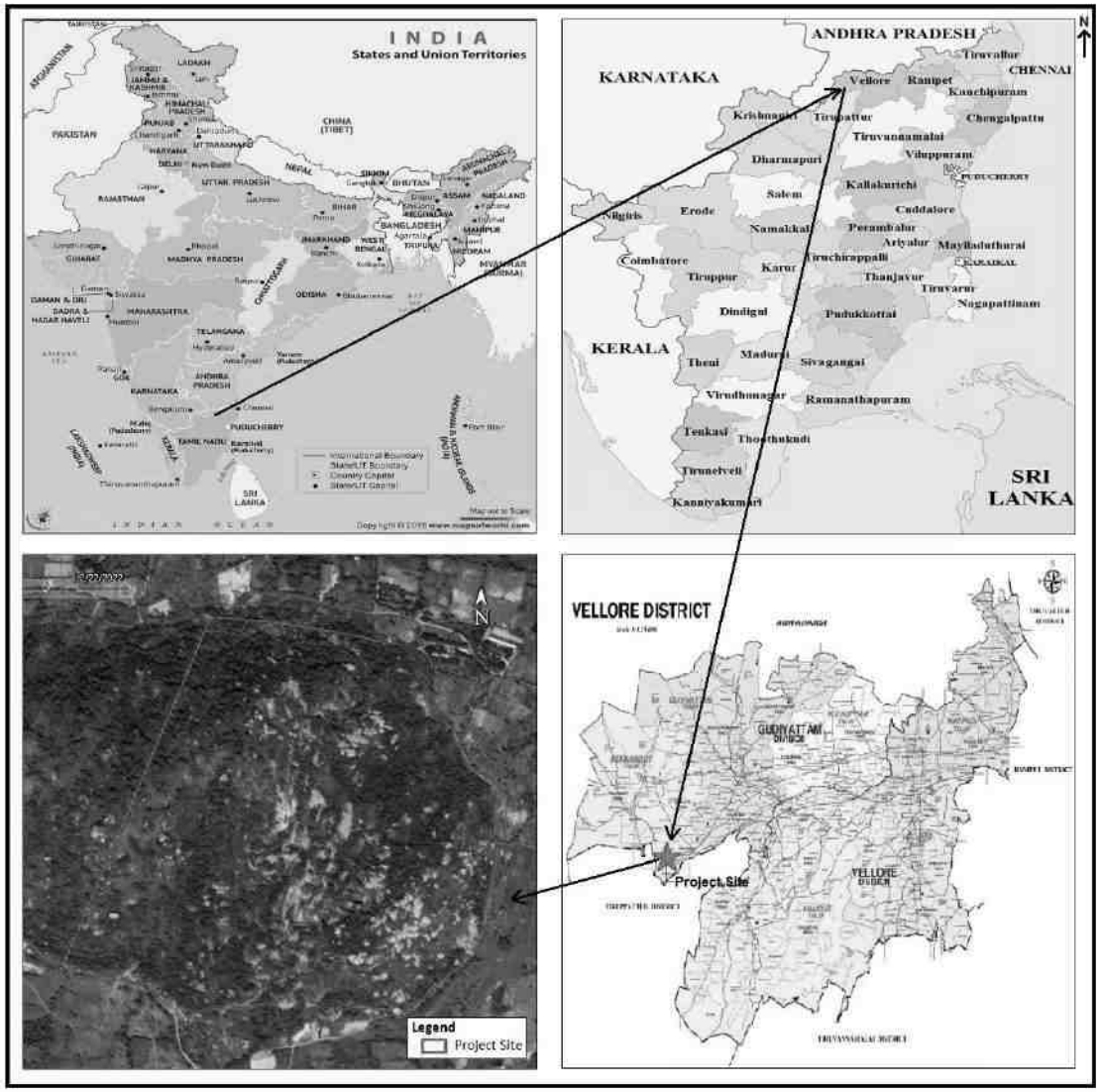



**Figure 2-1 Project Location Map**


**Figure 2-2 300 m Google Imagery of the lease area boundary**


**Figure 2-3 500m Radius Google Imagery of the project site**

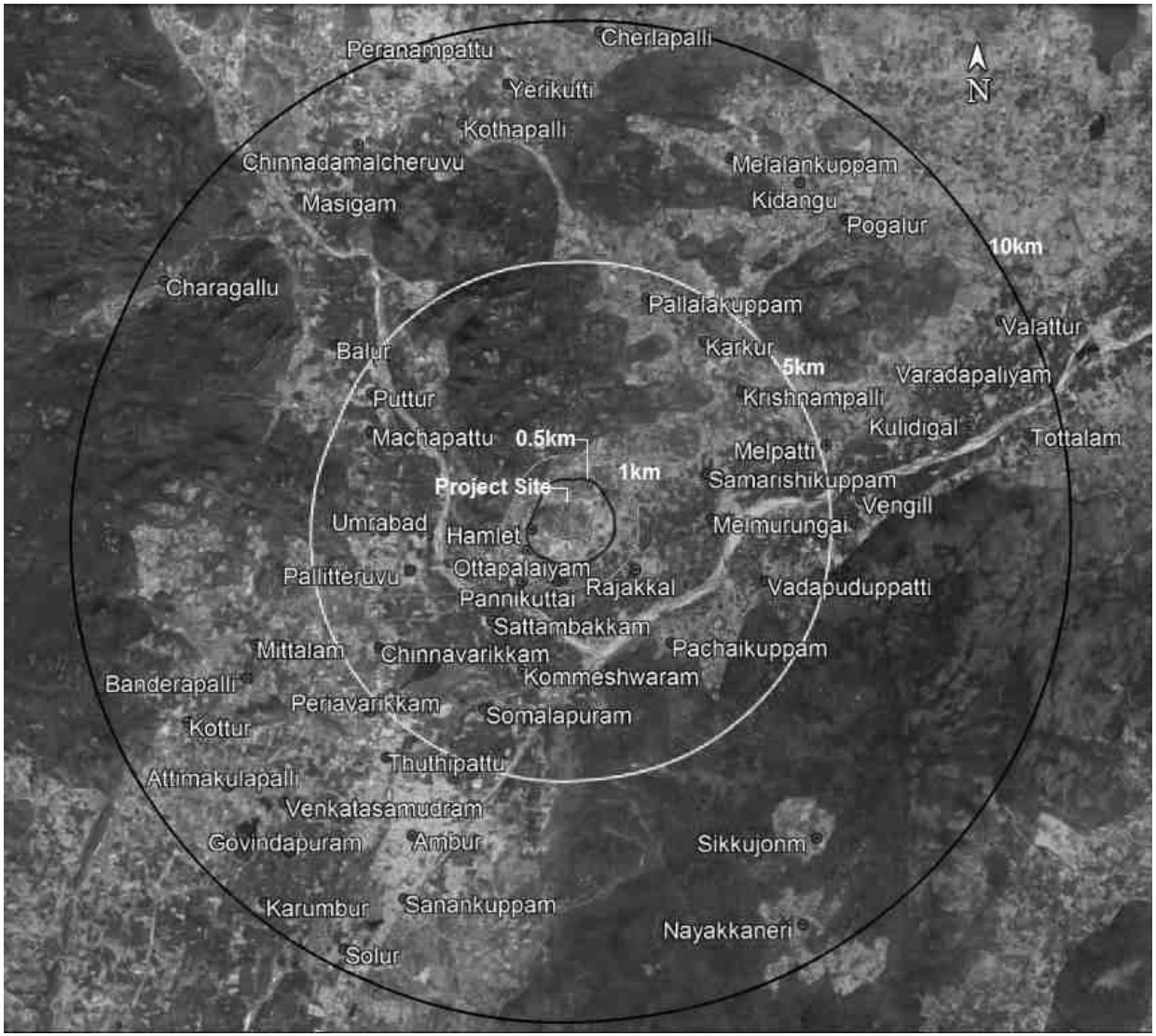



**Figure 2-4 10km radius Google Imagery of the project site**

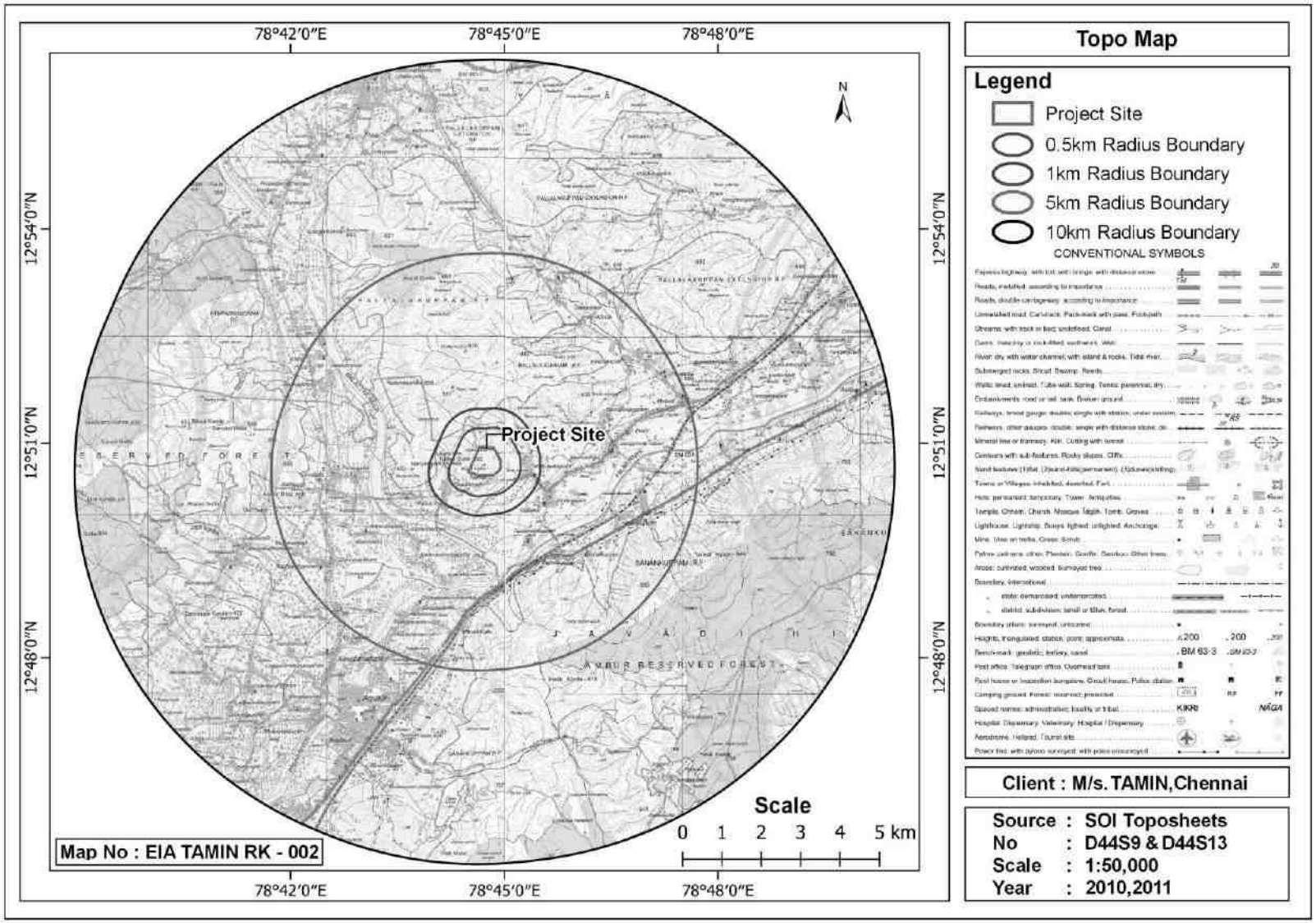



**Figure 2-5 Topo map of the study area**

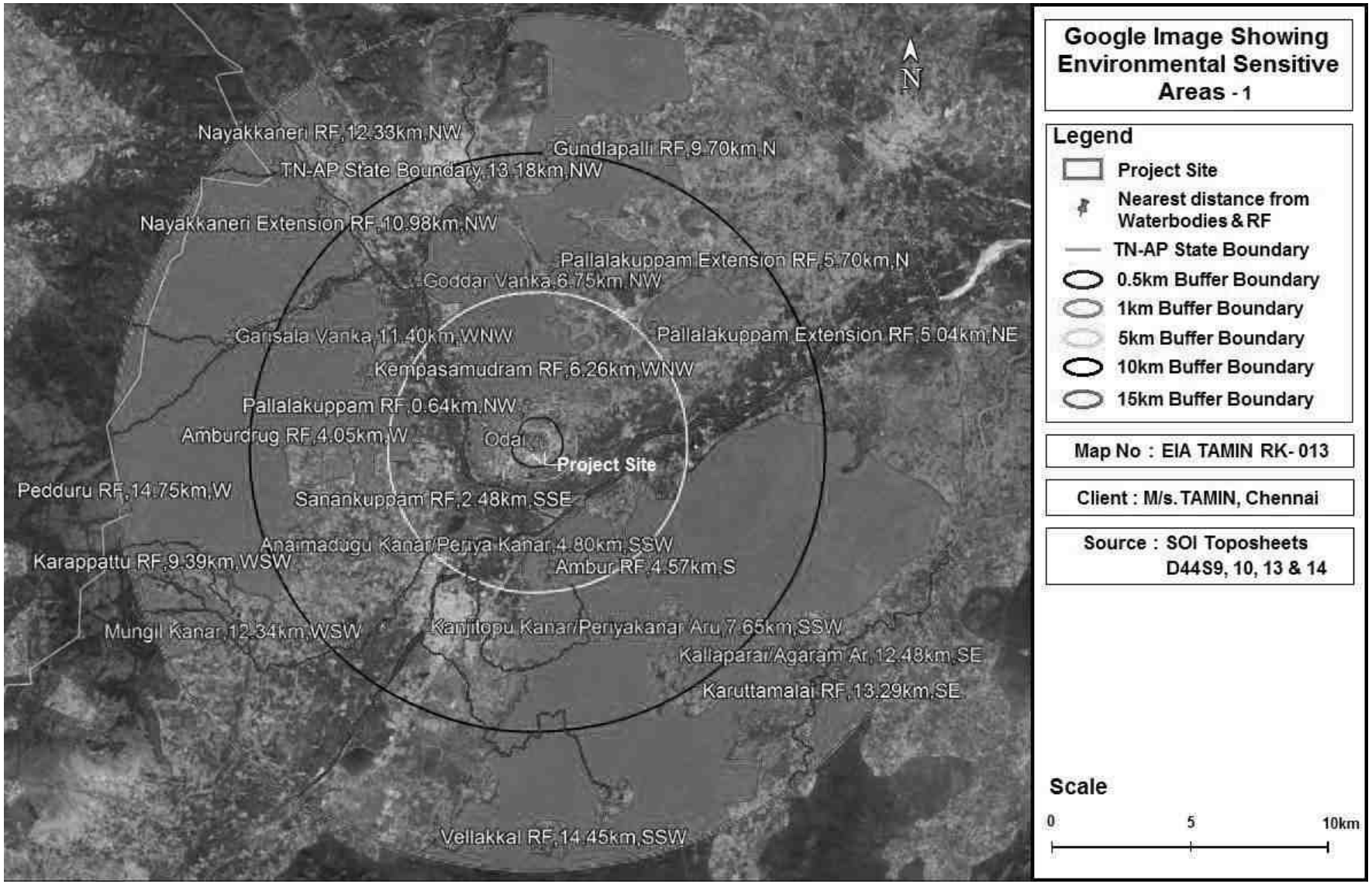



**Figure 2-6 (a) Environmental sensitive areas covering within 15 km from project boundary**

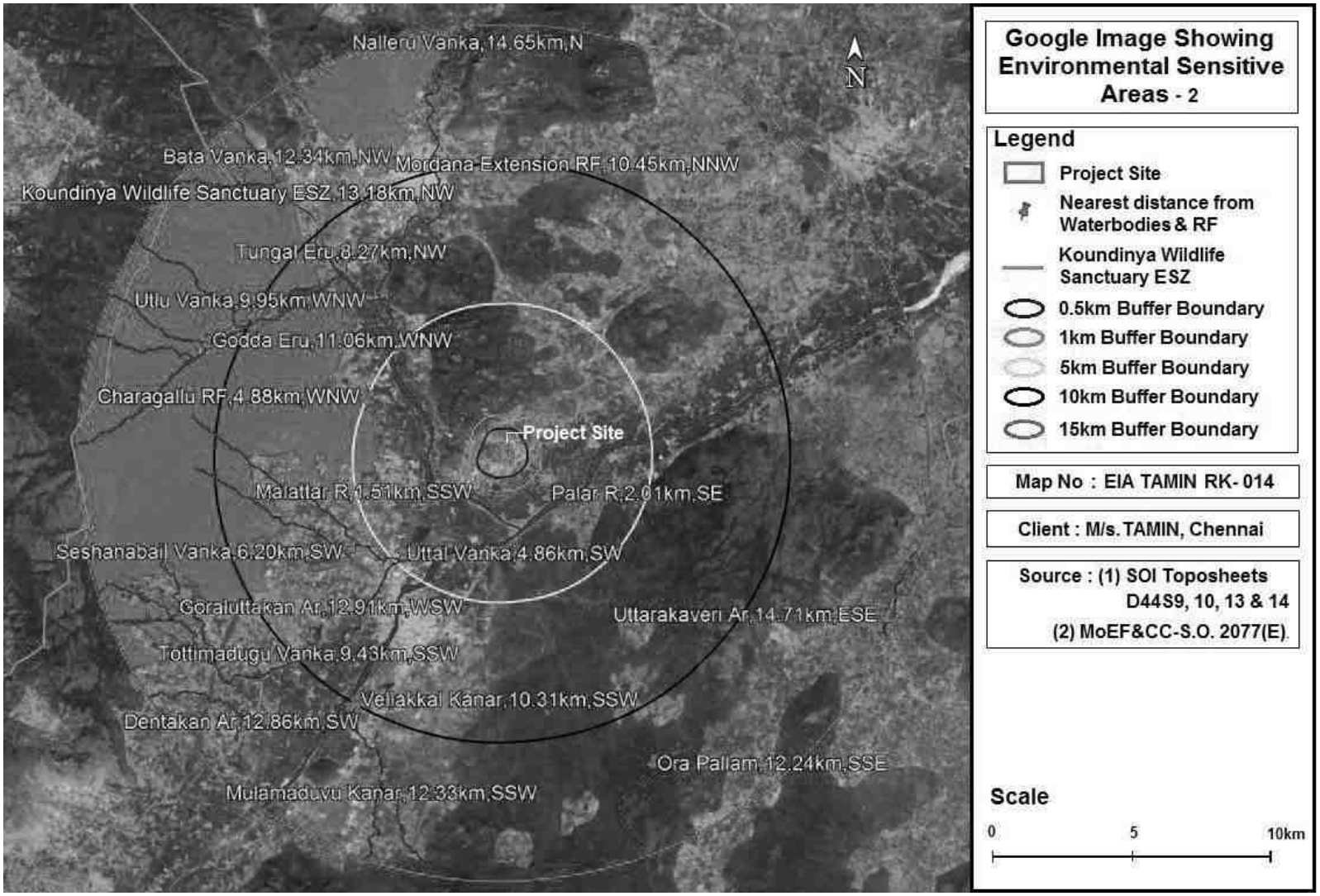



**Figure 2-7 (b) Environmental sensitive areas covering within 15 km from project boundary**

## 2.2 Project Summary & Salient Features

Project Summary & Salient Features within 15km radius of the project boundary is shown in **Table 2-1.**

**Table 2-1 Project Summary & Salient Features within 15km radius of the lease area boundary**

| S.No | Particulars | Details |
|---|---|---|
| 1. | Latitude | 78°44'28.52" E to 78°44'55.84" E |
| 2. | Longitude | 12°50'28.48" N to 12°50'54.66" N |
| 3. | Site Elevation above MSL | ~440 m AMSL |
| 4. | Topography | Hilly terrain |
| 5. | Land use of the site | Government land |
| 6. | Extent of lease area | 46.07.0 Ha |
| 7. | Quarry Lease (G. O.3(D)No.75) | 20 Years from 03.07.2007 to 16.09.2027 |
| 8. | Scheme of mining-1 | Letter No. 18349/MM5/2008, Dated 10.07.2009 for 72.44 .0 Ha |
| 9. | Modified Scheme of mining-II | Letter No. 15738/ML2/2013, Dated 03.11.2015 for 46.07.0 Ha |
| 10. | Modified Scheme of mining-III | Vide Rc No. 5167/MM4/2020, Dated 16.12.2020 for 46.07.0 Ha |
| 11. | | |
| 12. | Water Requirement | 25 KLD |
| 13. | Power requirement through DG Set | 120 KVA (DG Set 1*120 kVA) |
| 14. | Fuel requirements (Lts/Day) | 200 |
| 15. | Manpower | Direct-35 & Indirect -20 |
| 16. | Municipal Solid waste Generation (Kg /day | 15.75 |
| 17. | Waste Oil generation (Lts/Y) | 3.0 |
| 18. | Project Cost in Lakh | 99.97 |
| 19. | Nearest highway | ➢ SH-130 (Gudiyatham - Vaniyambadi) ~0.19km (S)<br>➢ NH-48((Chennai - New Delhi)) ~ 2.30 km (SE) |
| 20. | Nearest railway station | Pachchakuppam Railway Station ≃2.40 km (SSE) |
| 21. | Nearest airport | Tirupati International Airport ≃119.95km (NE) |
| 22. | Nearest town / city | **Nearest Town:** Ambur ≃4.09 km (SW)<br>**Nearest City:** Vellore ≃33.00 Km (ENE) |
| 23. | Water body | **S. No** / **Water bodies** / **Distance (km)** / **Direction**<br>1 / Pond near Melkottakuppam / 0.22 / SE<br>2 / Lake near Melkottakuppam / 0.23 / ESE<br>3 / Malattar R / 1.51 / SSW<br>4 / Palar R / 2.03 / SE<br>5 / Chinnavarikkam Eri / 3.20 / SW<br>6 / Tottimadugu Vanka / 3.55 / SSW<br>7 / Anaimadugu Kanar/Periya Kanar / 4.86 / SSE<br>8 / Uttal Vanka / 4.88 / SW<br>9 / Seshanabail Vanka / 6.20 / SW<br>10 / Goddar Vanka / 6.75 / NW |

| | | | | | |
|---|---|---|---|---|---|
| | | 11 | Kanjitopu Kanar/Periyakanar Aru | 7.65 | SSW |
| | | 12 | Tungal Eru | 8.27 | NW |
| | | 13 | Utlu Vanka | 9.95 | WNW |
| | | 14 | Vellakkal Kanar | 10.31 | SSW |
| | | 15 | Godda Eru | 11.06 | WNW |
| | | 16 | Garisala Vanka | 11.40 | WNW |
| | | 17 | Ora Pallam | 12.24 | SSE |
| | | 18 | Mulamaduvu Kanar | 12.33 | SSW |
| | | 19 | Mungil Kanar | 12.34 | WSW |
| | | 20 | Bata Vanka | 12.34 | NW |
| | | 21 | kallaparai/Agaram Aru | 12.50 | SE |
| | | 22 | Dentakan Ar | 12.86 | SW |
| | | 23 | Goraluttakan Ar | 12.91 | WSW |
| | | 24 | Nalleru Vanka | 14.65 | N |
| | | 25 | Uttarakaveri Ar | 14.71 | ESE |
| 24. | Hills / valleys | Nil in 15 km radius | | | |
| 25. | Archaeologically places | Nil in 15 km radius | | | |
| 26. | National parks / Wildlife Sanctuaries | Koundinya Wildlife Sanctuary ESZ, 13.18 km, NW | | | |
| 27. | Reserved / Protected Forests | **S.No** | **Reserve Forests** | **Distance (km)** | **Direction** |
| | | 1 | Pallalakuppam | 0.64 | NW |
| | | 2 | Sanankuppam | 2.48 | SSE |
| | | 3 | Amburdrug | 4.05 | W |
| | | 4 | Ambur | 4.57 | S |
| | | 5 | Charagallu | 4.92 | WNW |
| | | 6 | Pallalakuppam Extension | 5.04 | NE |
| | | 7 | Pallalakuppam Extension | 5.69 | N |
| | | 8 | Kempasamudram | 6.30 | WNW |
| | | 9 | Karappattu | 9.39 | WSW |
| | | 10 | Gundlapalli | 9.70 | N |
| | | 11 | Mordana Extension | 10.45 | NNW |
| | | 12 | Nayakkaneri Extension | 10.98 | NW |
| | | 13 | Karuttamalai | 13.29 | SE |
| 28. | Seismicity | Seismic zone-II | | | |
| 29. | Defense Installations | Nil within 15 km radius | | | |
| 30. | State Boundary | **S. No** | **State Boundary** | **Dist(km)** | **Direction** |
| | | 1 | TN-AP State Boundary | 13.18 | NW |

### 2.2.1 Nearest Human Settlement

The details of nearest human settlement from the project Site are provided below **Table 2-2.**

**Table 2-2 Nearest Human Settlement**

| S. No | Name of the Village | Distance in km | Direction | Population (census 2011) |
|---|---|---|---|---|
| 1 | Melkottakuppam | 0.16 | ESE | 1,975 |
| 2 | Hamlet | 0.38 | W | 60 |
| 3 | Ottapalalyam | 0.53 | WSW | 850 |
| 4 | Pannikuttai | 0.75 | SW | 735 |
| 5. | Rajakkal | 1.16 | ESE | 3,419 |
| 6. | Melmurungai | 1.91 | E | 2,035 |

## 2.3 Details of alternate sites considered

There is no alternative sites examined, The entire Colour Granite Bulk quantity of the blocks are produced and exported as raw blocks and is being processed at TAMIN's Granite processing units and exported as value added finished products.

## 2.4 Size or magnitude of operation

The colour granite mine is over an extent of 46.07.0 ha located in S.F.No.311 (Part), located at Rajakkal Village, Pernambut Taluk (erstwhile Gudiyatham Taluk), Vellore District, lies in the latitude of 12°50'28.48" N to 12°50'54.66" N and longitude of 78°44'28.52" E to 78°44'55.84" E. The area is marked in the survey of India Topo sheet No.57L/9 and 57L/13.

The colour granite quarrying operation is proposed to carry out by opencast semi mechanized method by formation of benches. Benches are proposed with a height of 6m & width bench not less than the height. Proposed production of mine is 18,132$m^3$ with a depth of Mining of 30m from the top of the hillock for the period of 20 years. The area applied for quarry lease is exhibits hillyterrain; the altitude of the area is ~440 AMSL.The Land Use Break up summarized as **Table 2-3.**

**Table 2-3 Land use Pattern of the quarry area**

| S.No | Description | Present area ( Ha) | Modified Revised Scheme of Mining-III Period in Ha | Area at the end of the quarry (Ha) | Percentage of Area (%) |
|---|---|---|---|---|---|
| 1. | Area under quarrying | 3.18.0 | 0.95..0 | 41.32.0 | 89.88 |
| 2. | Waste Dump | 1.58.5 | 0.90.5 | 2.20.0 | 4.77 |
| 3. | Infrastructure | 0.03.0 | - | 0.03.0 | 0.06 |
| 4. | Roads | 1.03.5 | - | 0.05.0 | 0.10 |
| 5. | Green belt | 2.48.5 | 0.06.5 | 2.39.0 (0.09.0 Ha above waste dump) | 5.18 |
| 6. | Unutilized | 37.75.5 | 36.33.5 | 0.08.0 | 0.17 |
| | **Total** | **46.07.0** | **37.75.5** | **46.07.0** | **100** |

### 2.4.1 Colour Granite Reserves

The available mineable reserve calculated by deducting 7.5m safety distance and bench loss. The updated geological reserves of colour granite estimated based on the geological cross-sections was 1,33,62,730$m^3$ as on 31.03.2018 by deleting the reserves depleted before mining plan period, during the modified mining plan period from (2013-2014 to 2017-2018). By applying the 25% recovery, the updated geological effective reserve as 33,40,683 $m^3$. The updated minerable reserves for colour granite have been arrived as 1,14,57,715$m^3$ as on 31.03.2018 after consideration of mineral locked-up in benches and safety barrier. By applying 25% recovery, the updated mineable effective reserves as 28,64,429 $m^3$.

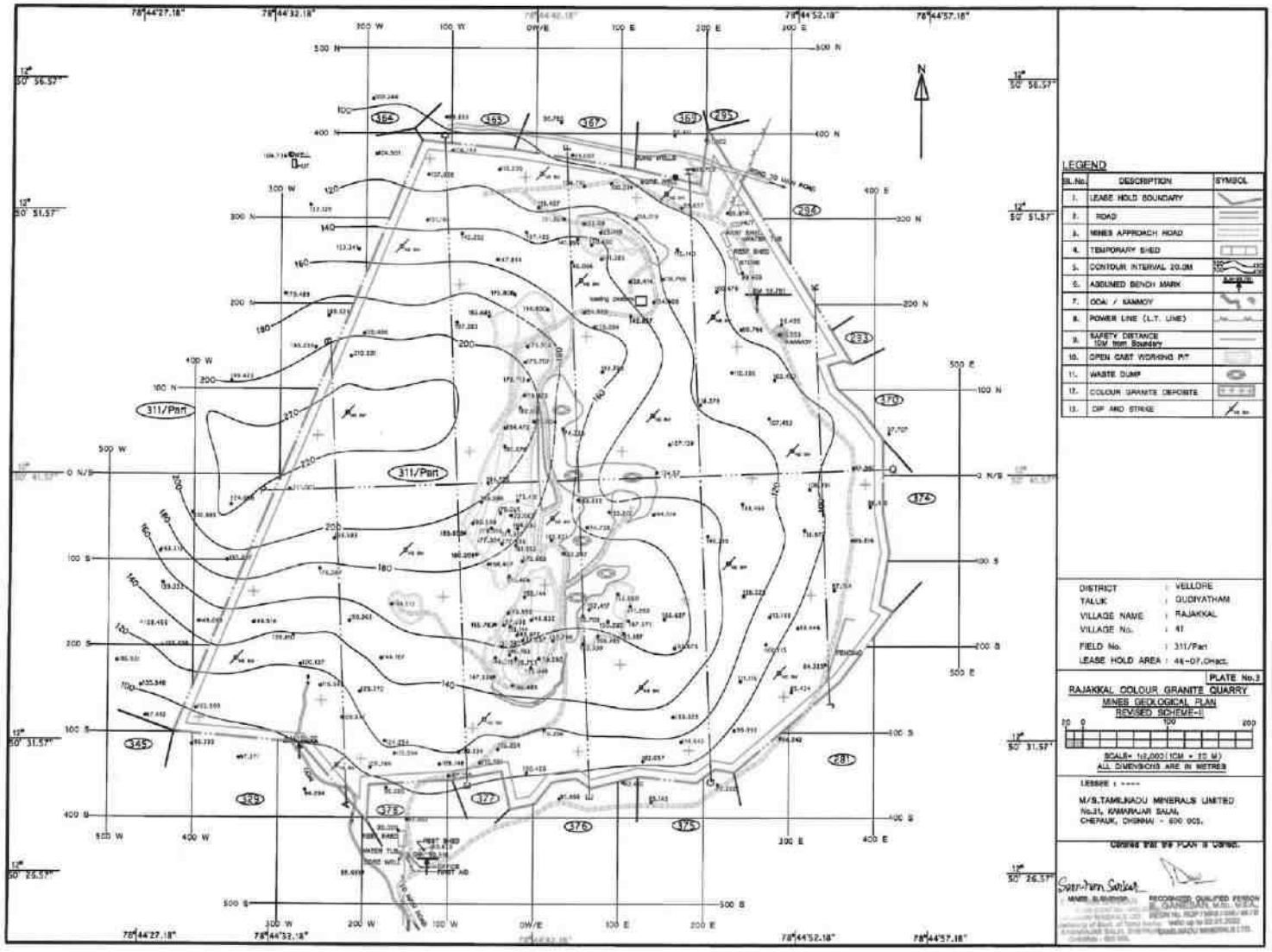



**Figure 2-8 Geological Plan & Section of the Granite Quarry**

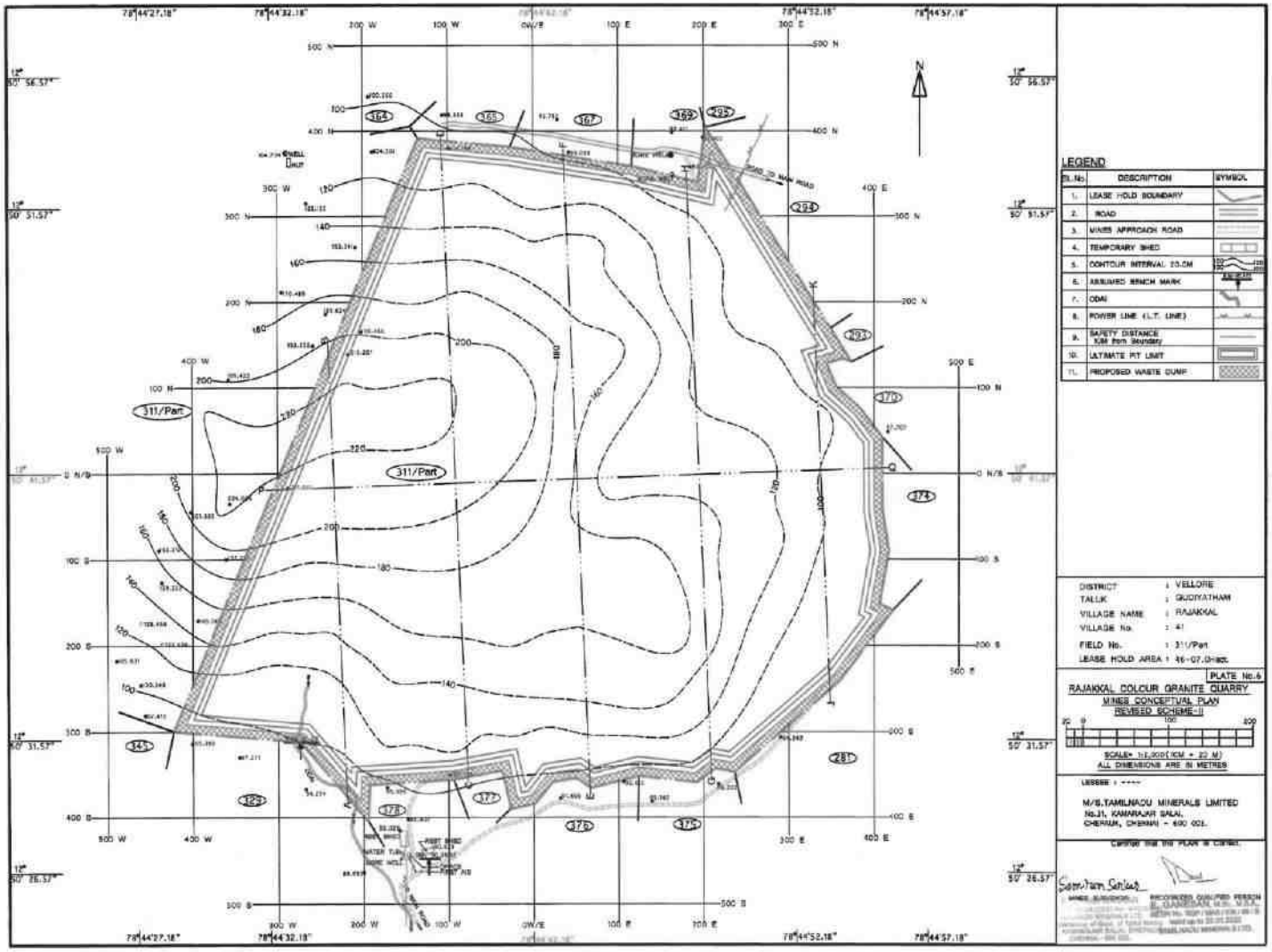



**Figure 2-9 Conceptual sections of the quarry**

### 2.4.2 Depletion of Reserves

The depletion of Reserves during the Mining plan period from 2003-2004 to 2007-2008 was 20,170$m^3$ and 2008-2009 to 2012-2013 was 61,960 $m^3$.The depletion of Geological Reserves during the Mining-I Plan period (from 2008-2009 to 2012-2013) was 61,960$m^3$,and during the Revised Modified Scheme of Mining-II period (2013-2014 to2017-2018) upto 31.03.2018 was nil.Hence, total depletion of reserves as 82,130$m^3$.

### 2.4.3 Additional reserves established category wise

No additional reserves established during the Modified Scheme of Mining Period.

**Table 2-4 Updated Geological reserves as on 31.03.2018**

| Section | Measurements (m) | | | ROM ($m^3$) | Effective Reserves ($m^3$) | Granite waste ($m^3$) |
|---|---|---|---|---|---|---|
| | Length | Width | Depth | | | |
| PQ-AB | 143.00 | 513.00 | 30.00 | 22,00,770 | | |
| PQ-CD | 143.00 | 742.00 | 30.00 | 31,83,180 | | |
| QR-EF | 143.00 | 736.00 | 30.00 | 31,57,440 | | |
| RS-GH | 143.00 | 690.00 | 30.00 | 29,60,100 | | |
| ST-JK | 143.00 | 453.00 | 30.00 | 19,43,370 | | |
| **Total Geological Reserves** | | | | **1,34,44,860** | | |
| (-)Past working upto 31.03.2018 | | | | (-) 82,130 | | |
| **Updated Geological Reserves as on 31.03.2018** | | | | **1,33,62,730** | **33,40,683@25%** | **1,00,22,047@75%** |

**Table 2-5 Updated Mineable reserves as on 31.03.2018**

| Bench | Measurements (m) | | | ROM ($m^3$) | Saleable Reserves ($m^3$) | Granite waste ($m^3$) |
|---|---|---|---|---|---|---|
| | Length | width | Depth | | | |
| PQ-AB & CD, EF, GH, JK | | | | | | |
| I$^{st}$Bench | 695.00 | 577.00 | 10.00 | 40,10,150 | | |
| II$^{nd}$Bench | 683.00 | 623.00 | 10.00 | 38,45,290 | | |
| III$^{rd}$Bench | 671.00 | 549.00 | 10.00 | 36,83,790 | | |
| **Total** | | | | **1,15,39,230** | | |
| (-)Past working upto31.03.2018 | | | | (-) 82,130 | | |
| **Updated Geological Reserves as on 31.03.2016** | | | | **1,14,57,715** | **28,64,429@25%** | **85,93,286@75%** |

## 2.5 Summary of the Magnitude of Operation

The Mining plan was approved by the Commissioner of Geology & mining, Chennai vide letter No.9017/MM2/2003, dated 26.06.2004. Subsequently, TAMIN submitted the First Scheme of Mining for the period from 2008-2009 to 2012-2013 also TAMIN submitted the revised Mining Scheme- II and got approval via Vide Letter No. 15738/ML2/2013, Dated 03.11.2015 for 46.07.0 Ha. Then TAMIN got approval of revised Mining Scheme – III via Vide Rc No. 5167/MM4/2020, Dated 16.12.2020 for 46.07.0 Ha

Year wise production details for 5 years (2018-2019 to 2022-2023) is summarized in **Table 2-6.**

**Table 2-6 Yearwise Development/Production for the Five Years (2018-2019 to 2022-2023)**

| S. No | Year | ROM ($m^3$) | Recovery @ 25 % ($m^3$) | Total Waste Generation ($m^3$) | | | |
|---|---|---|---|---|---|---|---|
| | | | | OB | SB | Granite Rejects | Total |
| 1 | 2018-2019 | 3629 | 907 | - | - | 2722 | 2722 |
| 2 | 2019-2020 | 3625 | 906 | - | - | 2719 | 2719 |
| 3 | 2020-2021 | 3619 | 905 | - | - | 2714 | 2714 |
| 4 | 2021-2022 | 3640 | 910 | - | - | 2730 | 2730 |
| 5 | 2022-2023 | 3619 | 905 | - | - | 2714 | 2714 |
| **Total** | | **18132** | **4533** | **Nil** | **Nil** | **13599** | **13599** |

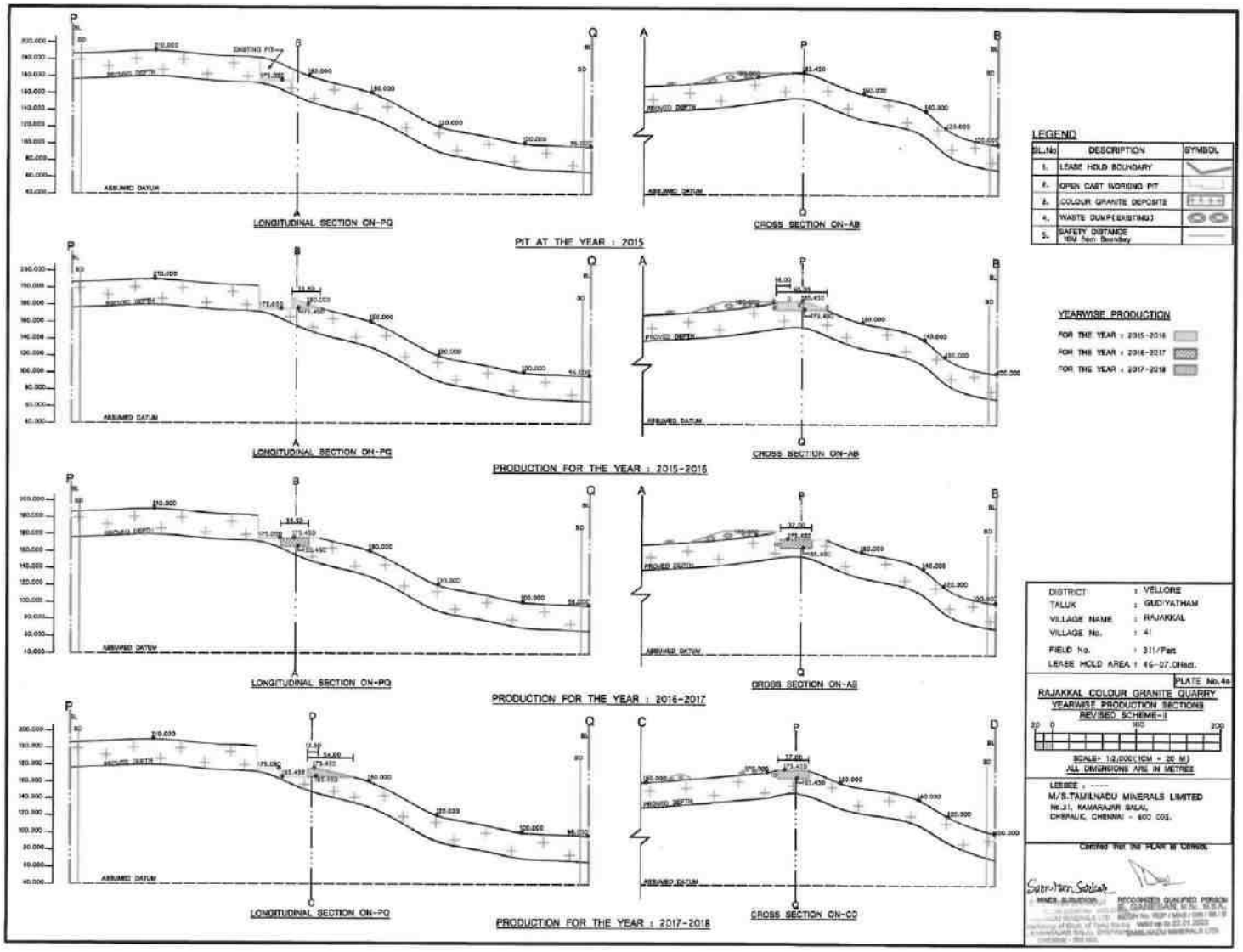



**Figure 2-10 Year wise production development Plan for the Next five years (2013-2014 to 2017-2018)**

## 2.6 Project Cost

Project cost of the project is shown in **Table 2-7.**

**Table 2-7 Project cost of the project**

| S. No | Description of the Cost | Cost in Lakhs |
|---|---|---|
| **I. Fixed Asset Cost** | | |
| 1 | Land Cost | Nil because of Govt. Land |
| | Labours Shed | 50,000/- |
| | Sanitary facilities | 50,000/- |
| | Fencing Cost | 1,25,000/- |
| | **Sub Total** | **2,25,000/-** |
| **II. Operational cost** | | |
| | Jack Hammers (6 nos) | 1,98,000/- |
| | Compressor (2 nos) | 19,82,000/- |
| | Diamond wire saw (1 no) | 4,87,000/- |
| | Diesel General 120KVA | 4,00,000/- |
| | Excavator (1 no). hire | 6,00,000/- |
| | Tippers (2 nos) | 58,00,000/- |
| | Drinking water facility for the labours | 50,000/- |
| | Safety kits | 50,000/- |
| | **Sub Total** | **95,67,000/-** |
| III | **EMP Cost** | |
| | Afforestation | 30,000/- |
| | Water Sprinkling | 50,000/- |
| | Water Quality Test | 25,000/- |
| | Air Quality Test | 25,000/- |
| | Noise/Vibration Test | 25,000/- |
| | CSR activities | 50,000/- |
| | **Sub Total** | 2,05,000/- |
| | **Grand Total** | **99,97,000/- ≃Rs. 1 Crore** |

## 2.7 Technology&Process Description

### 2.7.1 Technology

Primary step of mining of minerals is the removal of the deposits from the ground. Once the minerals / ore are removed, additional preparation process is required to isolate the valuable minerals from their waste gangue minerals. There are two basic method of mining of minerals opencast and underground mining. The choice of method depends on the geologic, hydrological, geo-technical, geographic, economic, technological, environmental, safety, Socio - political and financial considerations.

The major purpose of mine development is to provide auxiliary and support facilities for physically opening a surface or underground, or mine and bringing it to full production is to be planned. The facilities will not contribute directly to the production operation. It is a period of intensive and diversified activity on the project site with environmental impacts, which are usually different in

nature from operational impacts, which are crucial for successful environmental management. Schematic Diagram of Mining Process is given in **Figure 2-11.**

### 2.7.2 Method of mining-Open Cast Working

In accordance with the Regulation 106 (2)(a) of the Metalliferous Mines Regulations 1961, in all open cast workings where the ore body forms hard rock, the working faces and sides should be adequately benched and sloped. A bench height not exceeding 6m and a bench width not less than the height has to be maintained. The slope angle of such benches and sides should not exceed 60° from the horizontal. However, observance of these statutory provisions into in granite dimensional stone mining is seldom possible due to the field difficulties and technical reasons as below:

- Recovery of the granite mineral is to be as undamaged rectangular dimensional blocks. In the attempt to the benches and sides with the above statutory parameters haphazard blasting may be involved.
- In which case the commercial granite body may get spoiled due generation of blasting cracks.In the exercise of forming the benches with 60° slope within the granite deposit, theportion confined within the 60° as we as its complimentary part in the extricated block will become as mineral waste while shaping into rectangular blocks.
- The granite industry needs blocks as huge as few cubic meters volume withmeasurements upto 3m x 2m x 2m.
- Production of such huge blocks with a moving bench of 6m height is not possible. Production of such huge blocks in turn increases the recovery and reduces the mineral waste during dressing.
- Blocks of smaller size of certain varieties of granite are not marketable now-a-days. Formation of too many benches with more height and the width equal to the heightmay lease to mineral lock up.

Hence in order to avoid granite waste and to facilitate economical and convenient mining operations, it is proposed to obtain relaxation to the provisions of Regulation 106 (2) (a) up to a bench parameter of 6m height and 3m width with vertical faces. Such a provision for relaxation of the Regulation has been provided within the regulation 106 (2) (a). Further, it is to be noteworthy that opencast granite mining operations with the above proposed bench parameters may not be detrimental to Mines Safety, since the entire terrain is made up of hard rock, compact sheet and possess high stability on slope even at higher vertical angles. It is proposed not to backfill the pit in as much as good quantities of reserves are underlying the pits. The stock yard for the granite blocks produced and the dressing yard where the manual dressing and shaping of the blocks are carried out are located near the working pit in order to minimize the lead from the pit to the dressing yard and stock yard. A mine office, store room, first-aid room and workers rest shelter have been provided.

### 2.7.3 Process Description

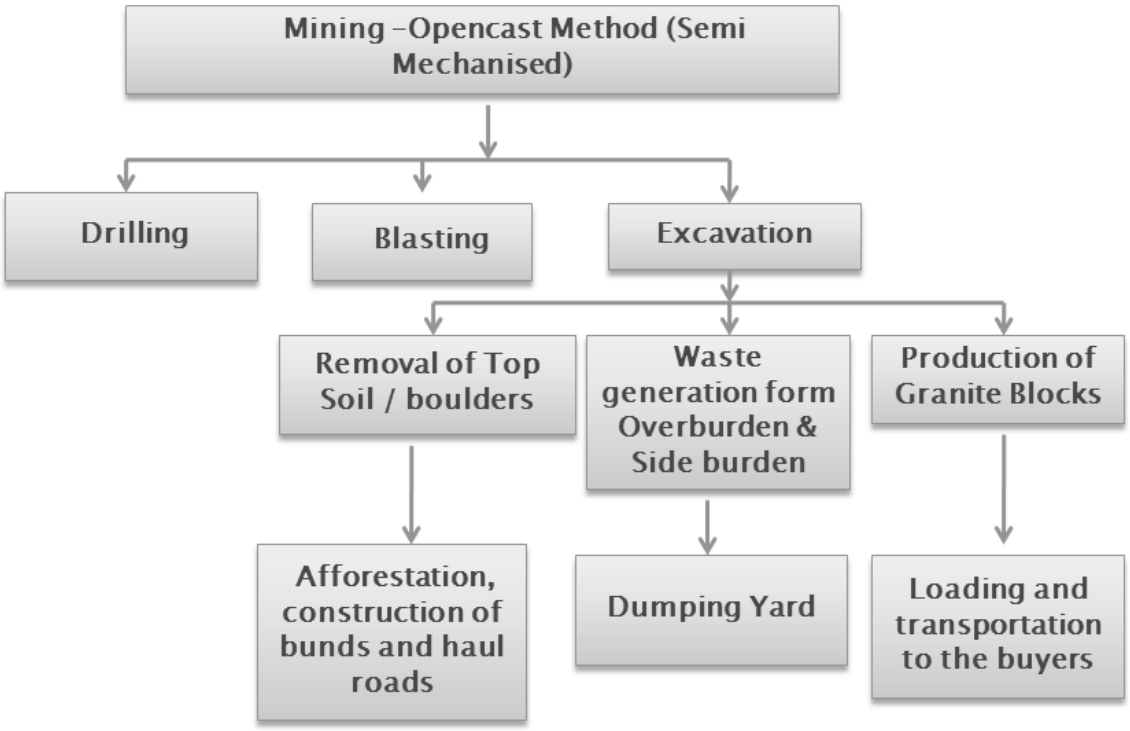



**Figure 2-11 Schematic diagram of the mining process**

**Mining**

Open cast, semi-mechanized mining with 6m vertical bench with a bench width of 6m has been proposed. Under the regulation 106 (2) (a) of the Metalliferous Mines Regulation 1961 in all open cast working in hard ore body, the benches and sides should be properly benched and sloped. The eight of any benches shall not exceed 10m and the width thereof shall not be less than the height has to be maintained.

The benches shall be sloped at an angle of more than 60° from the horizontal. The production of Black granite dimensional stone in this mine involves the following methods typical for granite stone mining, in contrast to any other major mineral mining.

All the above process continued together aiming at the liberation of huge volume of the granite body from the parent sheet rock is called 'primary cutting'.

1. The secondary splitting in to required size involves long hole drilling up to the bottom of the separated block and mild blasting along the required plans.
2. Now-a-days the secondary splitting is carried out by way of splitting and overturning cushion operational procedure. The procedure is by utilizing the compressed air available at the quarry at 7 to 8 bar pressure, initially (widening) splitting up to 15 to 18cms. Next by using super imposed cushion widening up to80cms and overturning of the blocks.

3. Removing the defective portions and dressing into the dimensional blocks are done manually using feather and wedges and chiseling respectively by the labour that are skilled in this work.

The defect free rectangular shaped dimensional stones as acceptable to consumers are produced by the method described as above which is constantly supervised by experienced mining geologist. The waste material generated during mining activity include the rock fragments of different angularity formed during the works, during the removal of naturally defective and uneconomical portions of the deposits and the working waste formed during dressing of the extricated blocks. Such waste material is proposed to the dumped along northern side the lease boundary / barren area where the commercial granite occurrences are not seen / the area covered with poor quality granite deposit identified to be uneconomical due to sheared and contacted nature or the presence of closely space natural joints, etc.

**Blasting**

The blasting parameters in the mining of Granite dimensional stones are entirely different from that of industrial minerals, since the basic purpose for the use of explosives in both the cases are entirely different. In the industrial minerals, maximum fragmentation and crushing of the ore is essential, whereas in the granite mining, the granite stones are to be extricated intact, without any damage on both the extricated part and the parent rock body. Wagon drilling and heavy blasting is seldom used in granite mining.

The portion to be extricated from the parent rock body is freed in all planes by adopting different methods as described in chapter 4.0. Only mild explosives such as gun powder, detonating cord, ordinary detonators etc will be used for the production of granite blocks. The blast holes of 32mm diameter are drilled upto the bottom of the horizontal plane all along the required planes without deviations sub grade drilling is avoided, since it may damage the underlying granite deposit.

Conventional 32 mm dia blast holes are drilled perfectly parallel to each other at 20 to 25cm intervals without any hole deviations, all along the required plane of splitting. The holes are drilled upto a depth few cms above the required horizontal plane. Sub grade drilling is not necessary since the splitting will be affected upto a further distance of few cms from the drill hole on blasting. Sub grade drilling may affecttheunderlying granite deposit.

Explosives such as gelatin, delay detonators etc may also be used occasionally at places further away from the granite deposit for certain development works such as forming approach roads to the working faces below ground level for forming flat surfaces to be used as dumping yard etc. The explosives required for this mine is obtained from the authorized, licensed dealer for which necessary permission will be obtained from the authority concerned. The blasting will be under the direct supervision of the statutory persons of TAMIN.

Now-a-days the splitting within the sheet rock is affected by diamond wire sawing, which largely reduces the use of explosives in granite mining. Many adverse effects of blasting are avoided and hence Diamond wire cutting will substantially increase the recovery. Hence it is proposed to deploy one wire saw machine in this quarry during its operation. Since the dimensional stones, which are needed without any cracks, high explosives are not used . The secondary splitting into required involves long hole drilling upto the bottom of the separated block along the required planes for which mostly rock breaking powder is used for splitting. It is chemically called as " Calcium Hydroxide Ca(OH)2.

Soundless cracking Agent is a non explosive- demolition agent that has the ability to safely demolish the rocks and reinforced concrete, cement without producing noise, vibrations, debris launches or environmental pollution. To carry out demolition CRACMAX need to be mixed with water and poured in the drilled holes. Now a days only wire sawmachine is being utilized for primary cutting to liberate the required sizes of blocks from the parent rock. The secondary spitting is carried out by the way of splitting and overturning cushtion operational procedure.

### 2.7.4 Loading & Transportation

The mode of transport of the granite blocks produced and marketed is by road of various consumer destinations and granite processing units located at different parts of the country. The blocks approved for export market are shipped through Chennai / Tuticorin Harbours to various countries.

**Exploration**

A number of valuable data for economical mining of the granite stone in this area have already been known from the actual mining practice during the past 33 years in this field.

1. Occurrence of the colour granite stone in economically viable quality and quantity has been established by geological mapping and visual examination by mining geologist experienced in granite mining which have been proved by actual mining practice.
2. The depth persistence of the granite stone is proved beyond the workable limits of 30 m from the petro genetic character of the granite body as well as from the actual mining practice. Considering the hilly deposit with sheet rock formation of 30m depth persistence from the surface level has been taken as economically workable depth to include all the three categories of mineral reserves viz, proved, probable and possible reserves.
3. The recovery of the saleable granite stones has been established as 5% from the visual exploration and from the data available by actual mining practices during the past mining in this area. As the sale of granite dimensional stone is in terms of volumes (cubic meter) only and not in terms of tonnage as in the case of the mining of Industrial minerals, the geological

reserves, mineable reserves and quantum of waste generation etc., are given in terms of cubic meter (volume) only.

The details of estimation of geological reserves and mineable reserves with reference to the geological plan and sections in Plate No: -3 and conceptual plan and sections in Plate No: -6 which have been furnished as **Annexure 5.**

**Storage of Explosives**

The applicant will engage an authorized explosive agency to carry out the small amount of blasting. As such no storage of explosives is envisaged for this proposal. The blasting will be supervised by DGMS authorized foreman/ mines manager.

**Mine drainage**

The mine area is an elevated ground with gentle slope on both sides of the linear dyke. Hence there is natural drainage system facilitating easy and comfortable drainage of rain waters. However, as a precaution, catch drains has been formed all around the working pit and it has been led to the natural drainage, so that the rain water will not enter the working areas. The water table will be at a depth of 15m BGL, A diesel engine with 5 H.P capacity is kept at the mine site to meet any eventuality of bailing out the rain water to the natural drainage outside to carry out the mine working uninterrupted.

## 2.8 Requirements

### 2.8.1 Land Requirement and Land Use Planning

Quarry Land use pattern details are shown in **Table 2-8 and** Land use pattern in provided in**Table 2-9.**

**Table 2-8 Quarry Land details**

| District | Taluk | Village | S.F. No. | Area in Ha | Occupancy /ownership |
|---|---|---|---|---|---|
| Vellore, Tamilnadu | Pernambut Taluk (erstwhile Gudiyatham Taluk), | Rajakkal | 311 (Part) | 46.07.0 | Government Poramboke land |

**Table 2-9 Land Use Pattern of the quarry area**

| S.No | Description | Present area ( Ha) | Modified Revised Scheme of Mining-III Period in Ha | Area at the end of the quarry (Ha) | Percentage of Area(%) |
|---|---|---|---|---|---|
| 1. | Area under quarrying | 3.18.0 | 0.95..0 | 41.32.0 | 89.88 |
| 2. | Waste Dump | 1.58.5 | 0.90.5 | 2.20.0 | 4.77 |
| 3. | Infrastructure | 0.03.0 | - | 0.03.0 | 0.06 |

| | | | | | |
|---|---|---|---|---|---|
| 4. | Roads | 1.03.5 | - | 0.05.0 | 0.10 |
| 5. | Green belt | 2.48.5 | 0.06.5 | 2.39.0 (0.09.0 Ha above waste dump) | 5.18 |
| 6. | Unutilized | 37.75.5 | 36.33.5 | 0.08.0 | 0.17 |
| | **Total** | **46.07.0** | **37.75.5** | **46.07.0** | **100** |

### 2.8.2 Water Requirement

The total water requirement is ~25 KLD. The total water requirement will be met from water tanker suppliers. Domestic wastewater will be treated in Septic Tank followed by soak pit. Septic Tank will be cleaned periodically. The water requirement break up is given in**Table 2-10.**

**Table 2-10 Water requirement breakup**

| S. No | Description | Water Requirement (KLD) |
|---|---|---|
| 1 | Drinking water& Domestic purpose | 0.2 |
| 2 | Wire saw cutting purpose | 1.3 |
| 3 | Dust suppression | 10.8 |
| 4 | Green belt | 12.3 |
| | **Total** | **24.6** |

### 2.8.3 Power Requirement

- DG Set with a capacity of 125 kVA will be used to meet the power requirement of 60 kVA.
- Diesel (HSD) will be used for quarrying machineries around 200 liters of HSD will be used per day.
- Diesel will be brought from nearby diesel pumps.

### 2.8.4 Fuel Requirement

The Power requirement is 60 kVA met through one DG Set with a capacity of 125kVA.Diesel (HSD) is being used for quarrying machineries around 200 liters/day of HSD is being used. Diesel will be brought from nearby diesel pumps. Fuel requirement is shown in**Table 2-11.**

**Table 2-11 Fuel requirement**

| S. No | Details | Existing |
|---|---|---|
| 1 | Power requirement (kVA) | 60 |
| 2 | DG Set capacity (kVA) | 1*125 |
| 3 | Diesel (Liters/day) | 200 |

***Source:*** *Project proponent*

### 2.8.5 List of Equipments

The list of Equipment is given in **Table 2-12.**

**Table 2-12 List of Machineries**

| S. No | Machinery | Capacity | Numbers |
|---|---|---|---|
| 1 | Excavator | 300 LC | 1 |
| 2 | Compressor | 400 cfm | 2 |
| 3 | Dumpers | 25 Tonnes | 2 |
| 4 | Diamond wire saw | 30 $m^3$/day | 1 |
| 5 | Jack Hammers (32mm dia.) | 1.2 to 6m | 6 |
| 6 | Diesel Generator | 125 kva | 1 |
| 7 | Tractor Mounted Air Compressor | | 1 |

### 2.8.6 Man power Requirement

Manpower details are given in **Table 2-13.**

**Table 2-13 Manpower Details**

| S.No | Description | No of persons |
|---|---|---|
| 1 | Manager | 1 |
| 2 | Mine Foreman | 1 |
| 3 | Operators & Drivers | 7 |
| 4 | Workers | 26 |
| | **Total** | **35** |

## 2.9 Solid Waste Management

The municipal Solid waste generation and management details are given in**Table 2-14.**

**Table 2-14 Municipal Solid Waste generation & Management**

| S. No | Type | Quantity Kg/day | Disposal method |
|---|---|---|---|
| 1 | Organic | 9.45 | Municipal bin including food waste |
| 2 | Inorganic | 6.30 | TNPCB authorized recyclers |
| | **Total** | **15.75** | |

As per CPCB guidelines: MSW per capita/day =0.45

## 2.10 Hazardous waste Management

The type of hazardous waste and the quantity generated are detailed in **Table 2-15.**

**Table 2-15 Hazardous Waste Management**

| Waste Category No | Description | Quantity (L/Year) | Mode of Disposal |
|---|---|---|---|
| 5.1 | Waste Oil | 3.0 | Will be Collected in leak proof containers and disposed TNPCB Authorized Agencies for Reprocessing/Recycling |

## 2.11 Infrastructure facilities

Sanitation facility, office room and rest room facilities will be provided.

## 2.12 Resource optimization/recycling and reuse envisaged in the project

No optimization/recycling and reuse envisaged in the Colour granite quarry.

## 2.13 Availability of water its source, Energy/power requirement and source

This quarry project does not require huge water and No electricity requirement is proposed for the project. The operations will be carryout in day time only.

## 2.14 Schematic Representations of the Feasibility Drawing which Give Information Important for EIA Purpose

A schematic representation of the overall feasibility and environmental assessment process is shown in **Figure 2-12**.

. The EIA process is composed of the following stages:

- Study of project information
- Screening & Scoping
- Environmental Pre-Feasibility study & application for approval of TOR
- Collection of detailed project management plan/report
- Baseline Data collection
- Impact identification, Prediction & Evaluation
- Mitigation measures & delineation of EMP
- Risk Assessment and Safety & Disaster Management plan
- Review & finalization of EIA Report based on the TOR requirements.
- Submission of EIA report for implementation of mitigation measures & EMP as well as necessary clearances from relevant Authority.

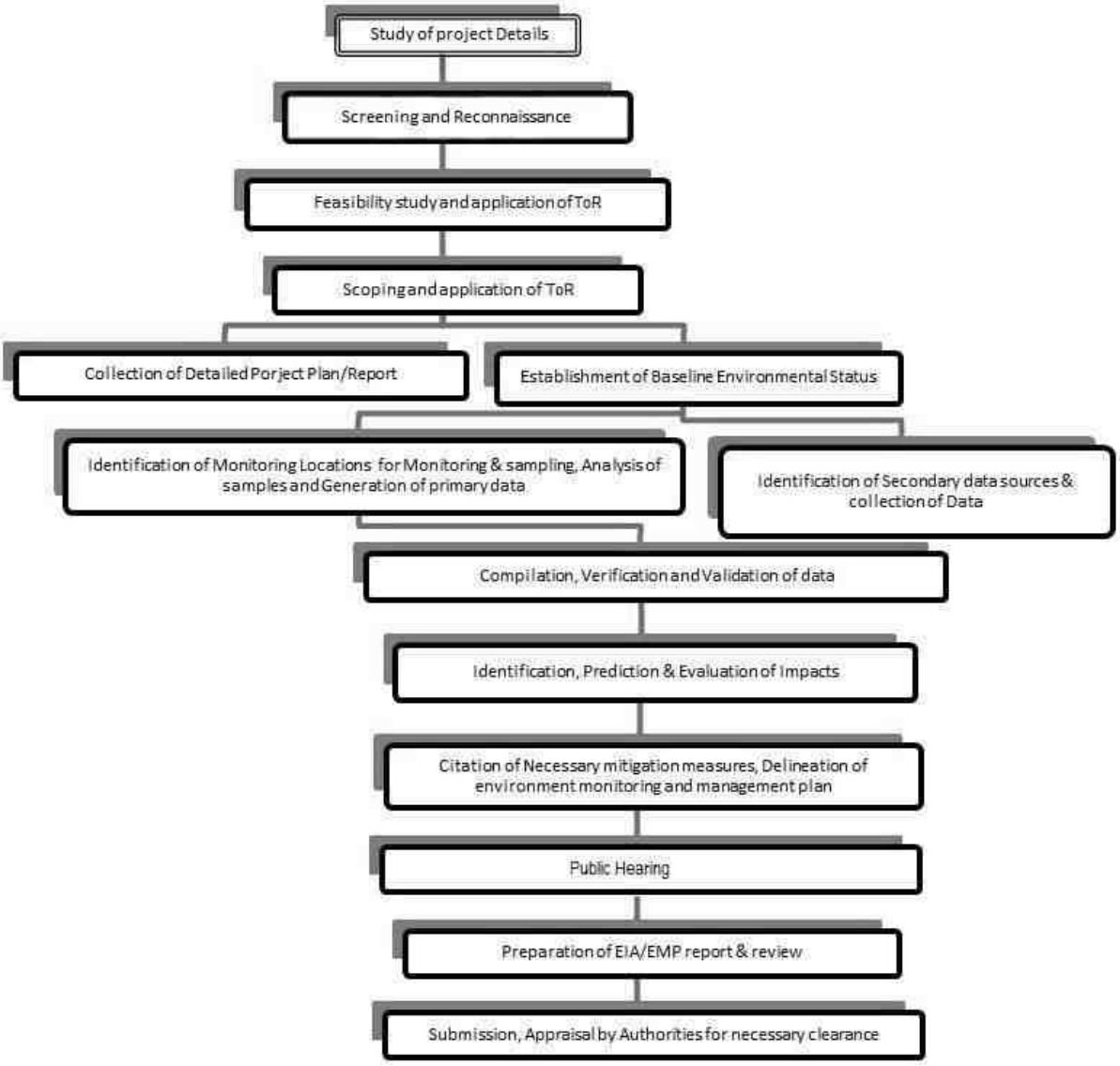



**Figure 2-12 Feasibility & Environmental Assessment Process**

## 2.15 Description of Mitigation Measures Incorporated Into the Project to Meet the Environmental Standards

From an environmental perspective, this phase is of paramount significance due to its potential to invoke long-term impacts. The adverse effects that are likely to occur during operational phase of the project are: Air Pollution (gaseous emissions), Effluent generation, Noise generation, Solid waste generation etc.

### 2.15.1 Land Environment

The land use of the existing area is already for Mining purpose. Hence there will be no change in land use pattern.

**i. Discharges on Land-Impact**

**Domestic:**

In existing domestic wastewater is disposed in to septic tank followed by soakpit.

**Mitigation Measures**

- The mine waste in the mine include the topsoil/rock fragments and rubbles generated as mineral rejects during production works and the country rock fragments generated during development works as approach road formation, formation or dumping yard sites etc.
- The dumps may also be source of airpollution due to wind erosion incase they are not properlyrehabilitated. Topsoil and overburden will be generated from the proposed mining project which will be stacked separately at the designated areas.

**ii. Impacts- Soil Contamination**

Potential impacts on land environment are envisaged due to hazardous and non-hazardous wastes generated due to various operations in the project site like municipal waste from domestic use and waste diesel oil from quarry machineries. Poor management of such materials/wastes from the operations is a potential risk of soil contamination.

**Soil – Mitigation Measures**

Good housekeeping and best practices of waste handling shall be adopted to eliminate/minimize the risks of soil contamination. The wastes generated will be stored in temporary storage facility and transferred to nearbymunicipal disposal bins. Waste diesel oil is being generated from quarry machineries is disposed through PCB Authorized dealers.

### 2.15.2 Air Environment

Mining operations contribute towards air pollution in two ways: addition of gaseous pollutants to the atmosphere and the dust particles. The gaseous pollutants include NOx, $SO_2$ and Hydrocarbons. The sources of pollutants from the mining activity include:

- Operation of Heavy Earth Moving Machinery (HEMM) which mostly run on diesel
- Loading /unloading operations
- Transportation of mineral/overburden in dumpers
- Ripping/Dozing, Drilling and Blasting operations.

**Sources of Air Pollution**

**a. Point Source/Single Source**

These are stationary sources, which emit air pollutants into the atmosphere from a certain fixed point. In the proposed mine, the following sources or activities from the point sources, which emit Suspended Particulate Matter (SPM).

**b. Drilling**

Drilling is an important activity of mining process. The secondary splitting in to required size involves long hole drilling up to the bottom of the separated block. Air pollution in theform of SPM is envisaged from this activity.

**c. Loading**

In the proposed project, the loading of side burden and granite rejects is proposed by Hydraulic excavators. This activity is likely to contribute air pollution in the form of SPM (dust) during discharge of material from bucket and gaseous pollutant like $SO_2$, $NO_x$ andHydrocarbons due to combustion of fuel (diesel) in the loading machinery.

**d. Unloading**

The generated rejects and granite at mine face will be transported by dumpers and unloaded at the designated locations. During unloading operation of both the material, air pollution in the form of SPM (dust) is envisaged due to discharge of material from the dumper and gaseous pollutants like $SO_2$, NOx and Hydrocarbons due to consumption of fuel (diesel) by dumper while unloading the material.

**e. Line Sources**

These are normally mobile sources, which emit atmospheric pollutants in the area through which they pass. The following are the sources of air pollution falling under thiscategory.

**f. Transportation**

The generated rejects and granite from site will be transported by haul road. Transportation also includes movement of service vehicles also in the mine lease area. The traffic on the haul roads is likely to contribute towards increase in dust and gaseous pollutants concentration in the area. However, this is more of a localized phenomenonwithin the mining areas that have limited human exposure.

**g. Area Sources/Multiple Sources**

These constitute pollution from various sources and activities situated in the mine lease area. The total mine area with all its mining activities constitutes the area source. These include all the mining activities, operations of equipment/machinery (HEMM), wind erosion from active mine pit, waste dump locations and haul road whichcontribute to the atmospheric pollution from the various units/activities.

**h. Instantaneous Sources**

The instantaneous sources consist of air pollution due to sudden/instantaneous activities like blasting in the mine area. Blasting process involves dislodgement of big blocks of hard strata/mineral from the mines. This operation generates maximum dust, which results in the increase of SPM concentration. It also contributes to emissions of certain gases (Oxides of Nitrogen and Ammonia) due to the use of explosives.

The size of the dust particles emitted into the atmosphere plays a major role in deciding the distance to which they may be transported. Particles of larger size fall fairly rapidly and closer to their source, because of gravitational settling. However, the aerosols because of their small size may be held in suspension for years in the atmosphere and may be transported on a global scale. Eventually, these smaller particles are collected in rain drops and fall on earth. The composition of these particles largely depends on the composition of the mineral being processed.

**Mitigation Measures**

- The increment in the fugitive emissions will be mainly due to transportation activity. Therefore emissions due to mineral handling during mining operation are not much and restricted to the lease area only.
- Proper mitigation measures are practiced during mining activities to control air pollution load below the prescribed limits are as follows:
- Watering of haul roads and other roads at regular intervals
- Spraying of water on permanent transport roads at required frequencies.
- Provision of dust filters / mask to workers working at highly dust prone and affected areas.
- Provision of green belt by vegetation for trapping dust.
- Greenbelt development along the haul roads, dumps and along the boundaries of the lease area.
- Utmost care will be taken to prevent spillage of sand and stone from the trucks.
- Covered tarpaulin for transport of materials

### 2.15.3 Noise & Vibration Environment

The sound pressure level generated by noise source decreases with increasing distance from the source due to wave divergence.The main sources of noise in the mine are as follows:

- Transportation vehicles
- Loading & unloading of minerals.
- Drilling and Blasting

**Noise Levels**

Heavy Earth Moving Machineries (HEMM) is deployed in mechanized mining operations. The noise levels of the major equipment are in the range of 88 to 90 dB (A). The noise levels are localized

within the mining areas and have human exposure. Occupational hazard is envisaged if proper personal protective equipment is not provided to operator.

**Vibration**

The vibration due to blasting can cause damage to the nearby structures if appropriate technology and control measures are not adopted in the blasting operation. Fly rock is another possible damage causing outcome of blasting. There are many factors which influence fly rock during blasting. Most important of these factors are long explosive column with little stemming column, improper burden, loose material or pebbles near the holes and long water column in the hole.

By adopting controlled blasting, the problems will be greatly minimized and the impacts will also be minimized by choosing proper detonating system, optimizing total charge and charge/delay.

Ground vibration, fly rock, air blast, noise, dust and fumes are the deleterious effects of blasting on environment. The explosive energy sets up a seismic wave in the ground, which can cause significant damage to structures and disturbance to human occupants. The impact will be minimized by choosing proper detonating system and optimizing total charge and charge/delay and by regular monitoring of magnitude of ground vibrations and air blast.

**Impact**

A noise generation source during operation phase is classified into two categories:

- Stationary sources due to operation of heavy duty machineries at the project site like Compressors, DG sets, Quarry vehicles and drilling machineries etc.

**Mitigation Measures**

- The major noise generating equipments like Compressors, DG sets, etc. will be enclosed in an acoustic enclosure designed for an insertion loss of 25 dB (A) and silencers to other equipment etc.
- Drilling will be carried out with the help of sharp drill bits which will help in reducing noise.
- Secondary blasting will be totally avoided.
- Controlled blasting with proper spacing, burden, stemming and optimum charge/delay will be maintained.
- The blasting will be carried out during favorable atmospheric condition and less human activity timings i.e. during lunch interval or during change of shifts.
- Proper maintenance, oiling and greasing of machines at regular intervals will be done to reduce generation of noise.
- Adequate silencers will be provided in all the diesel engines.
- Green Belt and Plantation will be developed around the mining activity area and long haul roads. The plantation minimizes propagation of noise.

- Periodical monitoring of noise will be done.
- The occupational noise exposure to the workers in the form of eight hourly time weighted average will be maintained well within the prescribed Occupational Safety and Health Administration (OSHA) standard limits.
- Adequate PPE will be provided to the staff exposing to noise risks.
- Acoustic silencers will be provided in equipment wherever necessary.
- Use of personal protective equipments/devices such as ear-muffs, ear plugs etc. will be strictly enforced for the workers engaged in high noise areas.
- Periodic maintenance of the equipment to be used in the developmental works will be carried out. Worn out parts will be replaced and rotating parts will be lubricated to minimise noise emissions.
- Implementation of greenbelt for noise attenuation will be undertaken: shrub plantation; landscaping with horticulture; and Tree plantation at vehicle parking areas and along approach roads.
- Ambient noise levels will be monitored at regular intervals during operational phase of the project.
- Low vibration generating machines/equipment will be selected to meet international standards and foundations will be so designed to minimize vibrations and secured properly.
- Vibration generating sources and their platforms should be maintained properly to minimize vibrations and related impacts.
- Vibration dampers will be provided around the source of generation.
- Transportation Management Plan will be prepared and the transportation of materials will be planned in line with the same.

### 2.15.4 Water Environment

**Impact on Existing Water Resources**

The total water requirement for quarry is 25 KLD. The total water requirement is met from private tanker. Domestic Wastewater is being disposed into Septic tank followed by soak pit & no toxic/other effluent generation. Hence the impact due to the project is very minimal.

#### i. Impacts on Surface Water Bodies

The surface water and groundwater are the life line of the villages. All the ponds in the area are working as recharge sites for the under lying groundwater and hence the surface water and ground water systems are acting like a single unit and therefore cannot be seen in Isolation.

Any contamination in surface drainage due to operation of project could collapse the system and will have serious impacts to the water resources especially the availability of potable water in the PIA

area. The impacts will be high in the core area. There will be negligible impact of mining on the surface water regime.

### ii. Impact on Ground Water

There will not be any ground water withdrawal, as the total water requirement is being met by private tank waters. As, the mine lease area is a Hilly area. The site Elevated ~440 AMSL. Hence, there will not be any groundwater level intersection as the planned depth of mining is 30 m from the top of the hillock.

**Mitigation Measures**

The following measures are proposed as a part of development to improve the ground water scenario and also to ensure that ground water is not contaminated.

Strategic plans such as implementing the following structures for rainwater harvesting and groundwater recharging purposes in project site will be adhered.

- Rainwater storage ponds/tanks
- Storage cum recharge ponds
- Monitoring of water quality and groundwater level variations in the project site.

### 2.15.5 Biological Environment

**Impact on Migratory Paths for Wildlife and Forest Blocks**

There are no identified migratory paths for major and minor wildlife in the project site and the study area. The identified fauna which are observed at the project site and in the study area are local migrants only. Therefore, the proposed project operations are not likely to have any adverse impact on the paths for avid-fauna.

**Mitigation Measures**

- Discharge of wastes into the water bodies during the quarry operation phase would not be allowed.
- Awareness will be given to workers about the importance and conservation of terrestrial ecology and biodiversity.

### 2.15.6 Solid Waste Management

**Impact due to Solid Waste Generation**

During quarry operations, various types of solid waste are likely to be generated which can be broadly categorized as Hazardous Waste and Non-hazardous Waste. Further, the generated solid waste generation may include Biodegradable, Recyclable and Inert compounds. The details of solid waste generation and its management proposed are discussed in **Chapter 2, Section 2.9.** If the solid waste

generated is not properly managed and disposed in unauthorized manner, it will impact on soil quality, groundwater and air quality.

**Solid Waste Management**

Strict guidelines will be put in place in order to manage the solid waste generation during the operational phase of the development. The main goals of the guidelines will be to ensure adopting recycling techniques and encouraging sorting of solid waste at source into organic and inorganic wastes. Waste management is given in **Figure 2.13.**

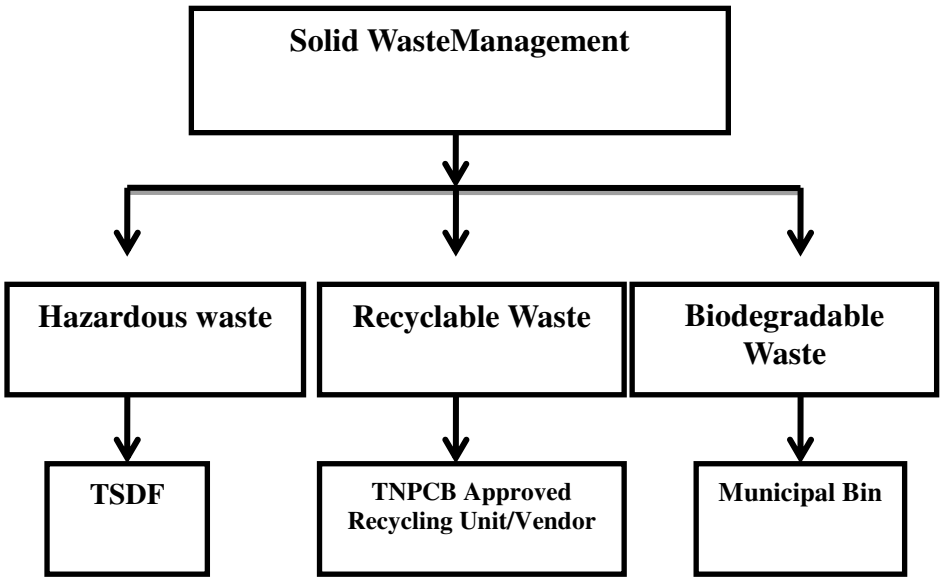



**Figure 2-13 Waste Management Concept**

## 2.16 Assessment of new and untested technology for the risk of technological failure

The project is Colour Granite quarry project. The technology used for mining is made by TAMIN in house there would not be any changes in the Mining. The mining technology is tried & tested method, and therefore there is no risk of technological failure. In addition to this the facility is being processed to care of the any technological failures.

# 3 DESCRIPTION OF ENVIRONMENT

## 3.1 Preamble

This chapter depicts the establishment of baseline for valued environmental components, as identified in and around the project area is located at survey no: 311 (Part), located at Rajakkal Village, Pernambut Taluk (erstwhile Gudiyatham Taluk),, Vellore District, Tamil Nadu State.. The primary baseline data monitored covered three (3) months i.e., from **Mid of Jan 2023 – Mid of April 2023**, and secondary data was collected from Government and Semi-Government organizations. The primary baseline data has been generated by M/s. Hubert Enviro Care Systems (P) Ltd, Chennai, and a MoEF & CC approved Environmental Testing Laboratory for the following Terrestrial environmental components.

- **Meteorology:** Temperature, Relative Humidity, Rainfall, Wind Speed & Direction- **Refer Section - 3.6**
- **Ambient Air Quality:** Particulate matter <10 micron size ($PM_{10}$), Particulate matter <2.5 micron size ($PM_{2.5}$), Sulphur Dioxide ($SO_2$), Nitrogen Dioxide ($NO_2$), Carbon Monoxide (CO), Lead (Pb), Ozone ($O_3$), Benzene ($C_6H_6$), Benzo (a) pyrene ($C_{20}H_{12}$), Arsenic (As), Nickel (Ni), Ammonia ($NH_3$) and free Silica - **Refer Section - 3.7**
- **Ambient Noise Levels:** Day equivalent noise levels, Night equivalent noise levels - **Refer Section - 3.8**
- **Water Quality:** Groundwater Quality, Surface Water Quality - **Refer Section - 3.9**
- **Soil Quality - Refer Section - 3.10**
- **Ecology - Refer Section - 3.11**
- **Social Economic Status - Refer Section - 3.12**

## 3.2 Study Area

A 10 km radial distance from the proposed project site boundary has been identified as the General study area for assessing the baseline environmental status. The core study area is the project area and its immediate surroundings to the tune of 1.0 km radius from the boundary. Further the Project Impact/Influence Area (PIA) is 10 km from the boundary of the project site which covers parts of in Rajakkal Village, Pernambut Taluk (erstwhile Gudiyatham Taluk), Vellore District, and Tamil Nadu State.

## 3.3 Description of the Study Area

As described in Chapter 1, M/s. TAMIN proposes Rajakkal Colour Granite quarry lease over an extent of 46 07.0Ha at S.F. Nos: 311 (Part), located at Rajakkal Village, Pernambut Taluk (erstwhile

Gudiyatham Taluk), Vellore District, Tamil Nadu State.. The proposed project site is located approximately at a distance of 2.40km to Nearest Railway Station - Pachakuppam Railway Station towards SSE and Project Site is located approximately at a distance of 119.95km Tirupati International Airport-Bengaluru towards NE and 168.56km to Chennai Port towards E. An overall idea of the study area with reference to the physical conditions are presented for better understanding in the following sections before proceeding into the section on the prevailing environmental conditions of the study area. The map showing the satellite image of the study area is given in **Figure 3-1** and Topo Map of the study area is given in **Figure 3-2.**

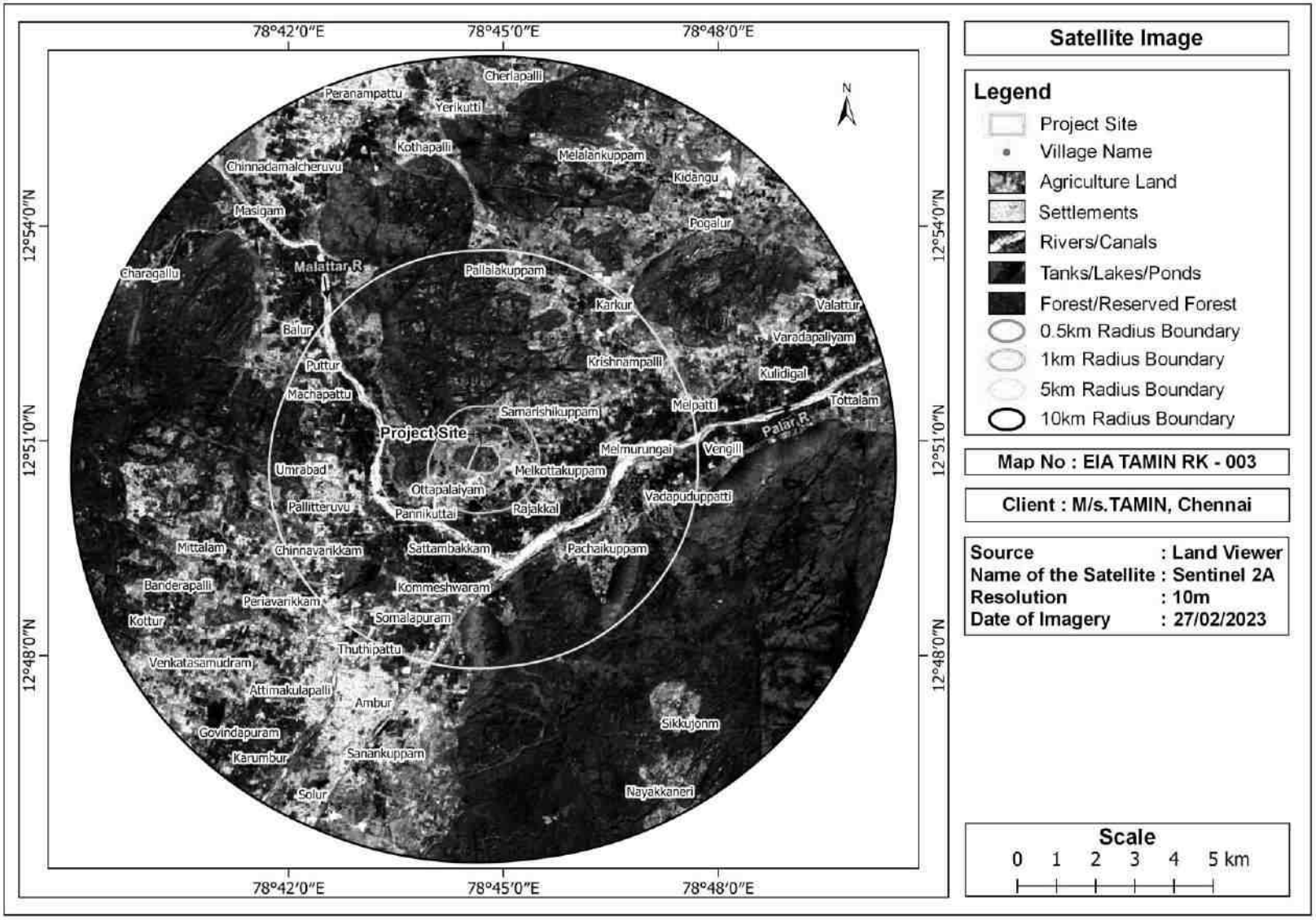



**Figure 3-1 Map showing the Satellite Image of the study area of Project**

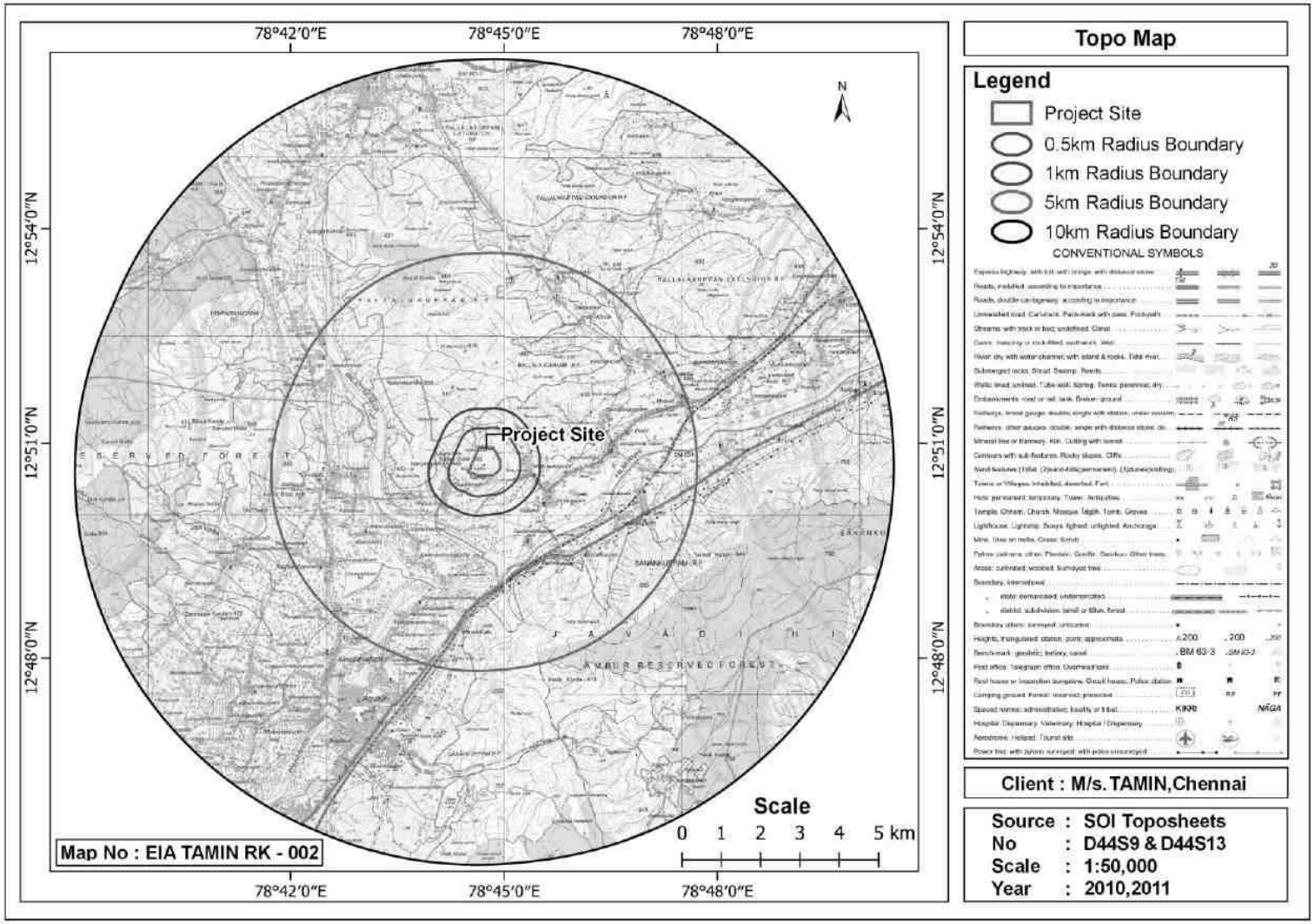



**Figure 3-2 Topo Map of Study area**

## 3.4 Environmentally/Ecologically Sensitive areas

This section details with the environmental sensitive areas present within the project site and surrounding environs. The environmental sensitive areas covering an aerial distance of 15 km from the project boundary is given in **Table 3-1.**

**Table 3-1 Environmental Sensitive Areas within 15km from Project Boundary**

| S. No. | Areas | Distance & Direction from project boundary |
|---|---|---|
| 1. | Monuments& Heritage | Nil |
| 2. | Wetlands, Watercourses or other water bodies, coastal zone | |

| S. No | Places | Distance (≈km) | Direction |
|---|---|---|---|
| 1. | Lake near Melkottakuppam | 0.23 | ESE |
| 2. | Malattar R | 1.51 | SSW |
| 3. | Palar R | 2.03 | SE |
| 4. | Chinnavarikkam Eri | 3.20 | SW |
| 5. | Goddar Vanka | 6.75 | NW |
| 6. | Pond near Melkottakuppam | 0.22 | SE |
| 7. | Tottimadugu Vanka | 3.55 | SSW |
| 8. | Anaimadugu Kanar/Periya Kanar | 4.86 | SSE |
| 9. | Uttal Vanka | 4.88 | SW |
| 10. | Seshanabail Vanka | 6.20 | SW |
| 11. | Kanjitopu Kanar/Periyakanar Aru | 7.65 | SSW |
| 12. | Tungal Eru | 8.27 | NW |
| 13. | Utlu Vanka | 9.95 | WNW |
| 14. | Vellakkal Kanar | 10.31 | SSW |
| 15. | Godda Eru | 11.06 | WNW |
| 16. | Garisala Vanka | 11.40 | WNW |
| 17. | Ora Pallam | 12.24 | SSE |
| 18. | Mulamaduvu Kanar | 12.33 | SSW |
| 19. | Mungil Kanar | 12.34 | WSW |
| 20. | Bata Vanka | 12.34 | NW |
| 21. | kallaparai/Agaram Aru | 12.50 | SE |
| 22. | Dentakan Ar | 12.86 | SW |
| 23. | Goraluttakan Ar | 12.91 | WSW |
| 24. | Nalleru Vanka | 14.65 | N |
| 25. | Uttarakaveri Ar | 14.71 | ESE |

| 3. | Reserved Forests & Wild Life Sanctuary | |
|---|---|---|

| S.No | Places | Distance (≈km) | Direction |
|---|---|---|---|
| | **Reserved Forests** | | |
| 1. | Pallalakuppam RF | 0.64 | NW |
| 2. | Sanankuppam RF | 2.48 | SSE |
| 3. | Amburdrug RF | 4.05 | W |
| 4. | Ambur RF | 4.57 | S |
| 5. | Charagallu RF | 4.92 | WNW |
| 6. | Pallalakuppam Extension RF | 5.04 | NE |
| 7. | Pallalakuppam Extension RF | 5.69 | N |
| 8. | Kempasamudram RF | 6.30 | WNW |
| 9. | Karappattu RF | 9.39 | WSW |
| 10. | Gundlapalli RF | 9.70 | N |

| | | | | | |
|---|---|---|---|---|---|
| | | 11. | Mordana Extension RF | 10.45 | NNW |
| | | 12. | Nayakkaneri Extension RF | 10.98 | NW |
| | | 13. | Karuttamalai RF | 13.29 | SE |
| | | **Wild Life Sanctuary** | | | |
| | | 1. | Koundinya Wildlife Sanctuary ESZ | 13.18 | NW |

| | | | | | |
|---|---|---|---|---|---|
| 4. | Routes or facilities used by the public for access to recreation or other tourist, pilgrim areas | **S.No** | **Nearest Highway** | **Distance (≈km)** | **Direction** |
| | | 1. | SH-130(Gudiyatham - Vaniyambadi) | 0.19 | S |
| | | 2. | NH-48 (Chennai - New Delhi) | 2.30 | SE |
| 5. | State, National boundaries | ➢ TN-AP State Boundary ≈ 13.18km, NW | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 6. | Densely populated or built-up area (Nearest Town, City, District) | **S. No** | **Places** | **Distance (≈km)** | **Direction** | **Population** |
| | | 1. | Melkottakuppam | 0.16 | ESE | 1,975 |
| | | 2. | Hamlet | 0.38 | W | 60 |
| | | 3. | Ottapalalyam | 0.53 | WSW | 850 |
| | | 4. | Pannikuttai | 0.75 | SW | 735 |
| | | 5. | Rajakkal | 1.16 | ESE | 3,419 |
| | | 6. | Melmurungai | 1.91 | E | 2,035 |
| | | **Nearest Town and City** | | | | |
| | | 1. | Nearet Town - Ambur | 5.0km | SW | |
| | | 2. | Nearest City - Vellore | 33.00km | ENE | |

| | | | | | |
|---|---|---|---|---|---|
| 7. | Nearest Railway station, Airport & port | **Nearest Railway Station, Airport & Port** | | | |
| | | **No** | **Places** | **Distance (≈km)** | **Direction** |
| | | 1. | Nearest Railway Station - Pachchakuppam | 2.40 | SSE |
| | | 2. | Tirupati International Airport | 119.95 | NE |
| | | 3. | Chennai Port | 168.56 | E |

| | | | | | |
|---|---|---|---|---|---|
| 8. | Areas occupied by sensitive man-made land uses (hospitals, schools, places of worship, community facilities) | **S. No** | **Places** | **Distance (≈km)** | **Direction** |
| | | **SCHOOLS** | | | |
| | | 1. | sankarapuram Govt PUM School | 0.74 | SW |
| | | 2. | Melkothakuppam Govt Middle School | 0.80 | E |
| | | 3. | Mailpatti Govt High School | 4.76 | ENE |
| | | 4. | Anaikar Oriental (Arabic) Hr Sec School | 5.66 | SSE |
| | | 5. | Peranampattu Govt Girls Hr Sec School | 9.44 | NNW |
| | | **COLLEGES** | | | |
| | | 1. | Jamia Darussalam Arabic College | 3.50 | W |
| | | 2. | Sri Aandal Arts and Science College for Women | 4.40 | E |
| | | 3. | Mazharul Uloom College | 6.88 | SSW |

| | | | | | |
|---|---|---|---|---|---|
| | | 4. | Merit Haji Ismail Sahib Art's & Science College | 10.07 | N |
| | | 5. | Thirumalai Madhanur Polytechnic College | 13.31 | E |
| | | **GOVERNMENT BUILDINGS** | | | |
| | | 1. | Oomerabad Police Station | 3.78 | W |
| | | 2. | Ambur Taluk Office | 4.38 | S |
| | | 3. | Ambur Combined Court | 6.77 | SSW |
| | | 4. | Ambur Fire Station | 6.93 | SSW |
| | | 5. | Pernambut Municipal Office | 10.40 | NNW |
| | | **HOSPITALS** | | | |
| | | 1. | Nariyambut Upgraded Govt PHC | 2.64 | WSW |
| | | 2. | Mailpatti Govt PHC | 4.94 | ENE |
| | | 3. | Ambur Govt Hospital | 6.68 | SSW |
| | | 4. | Madhanur Govt Hospital | 11.08 | ENE |
| | | 5. | Minnur Govt PHC | 13.98 | SSW |
| | | **RELIGIOUS PLACES** | | | |
| | | 1. | Koothandavar Temple | 0.52 | E |
| | | 2. | Ebenezer Lutheran Centenary Church | 1.69 | ESE |
| | | 3. | Oomerabad Masjid | 3.41 | W |
| | | 4. | Kailasagiri Murugan Temple | 4.32 | W |
| | | 5. | Jamia Masjid | 6.51 | SSW |
| | | 6. | Chowk Masjid | 9.80 | NNW |
| | | **INDUSTRIES** | | | |
| | | 1. | Shalini Fab Tech India Pvt Ltd | 0.20 | S |
| | | 2. | Eureka Leather Garments | 2.91 | SE |
| | | 3. | Ambur Co-operative Sugar Mills Ltd | 3.19 | ESE |
| | | 4. | Zyf Tex Pvt. Ltd | 3.87 | WSW |
| | | 5. | Mohib Shoes D Unit | 4.09 | SW |
| | | 6. | Mohib Shoe Enterprises Pvt Ltd | 4.66 | SW |
| | | 7. | Shams Shoes Pvt Ltd | 4.69 | SW |
| | | 8. | N Abdul Wajid and Co | 4.86 | SW |
| | | 9. | Tata International Ltd | 4.92 | SW |
| | | 10. | Naps (India) Footwear Co | 5.02 | SW |
| | | 11. | Ghouse Leather Exports | 5.03 | SW |
| | | 12. | Florence Shoe Factory | 5.07 | SSW |
| | | 13. | Itares Shoes pvt.Ltd | 5.14 | SW |
| | | 14. | Aston Shoes Private Limited | 5.24 | SSW |
| | | 15. | Rumana Leather Company | 5.47 | SSW |
| | | 16. | Farida Shoes Pvt Ltd | 6.09 | SSW |
| | | 17. | Sara Suole Pvt. Ltd | 6.83 | E |
| | | 18. | TALCO Pernambut Tannery Effluent Treatment Company Ltd | 8.62 | NNW |
| | | 19. | Lloyd Shoes India Pvt Ltd | 13.25 | NE |

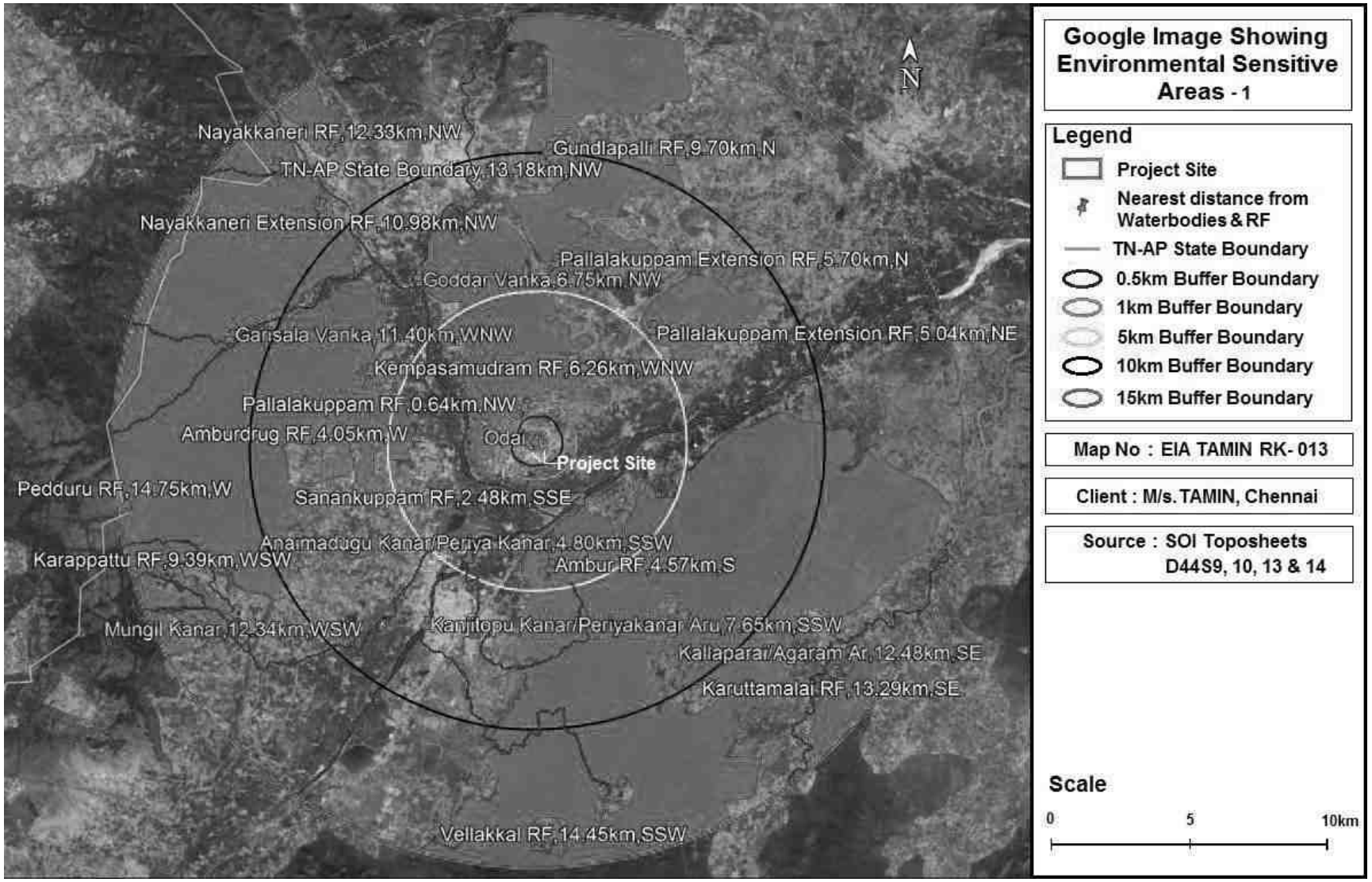



**Figure 3-3 (a) Environmental sensitive areas covering within 15 km from project boundary**

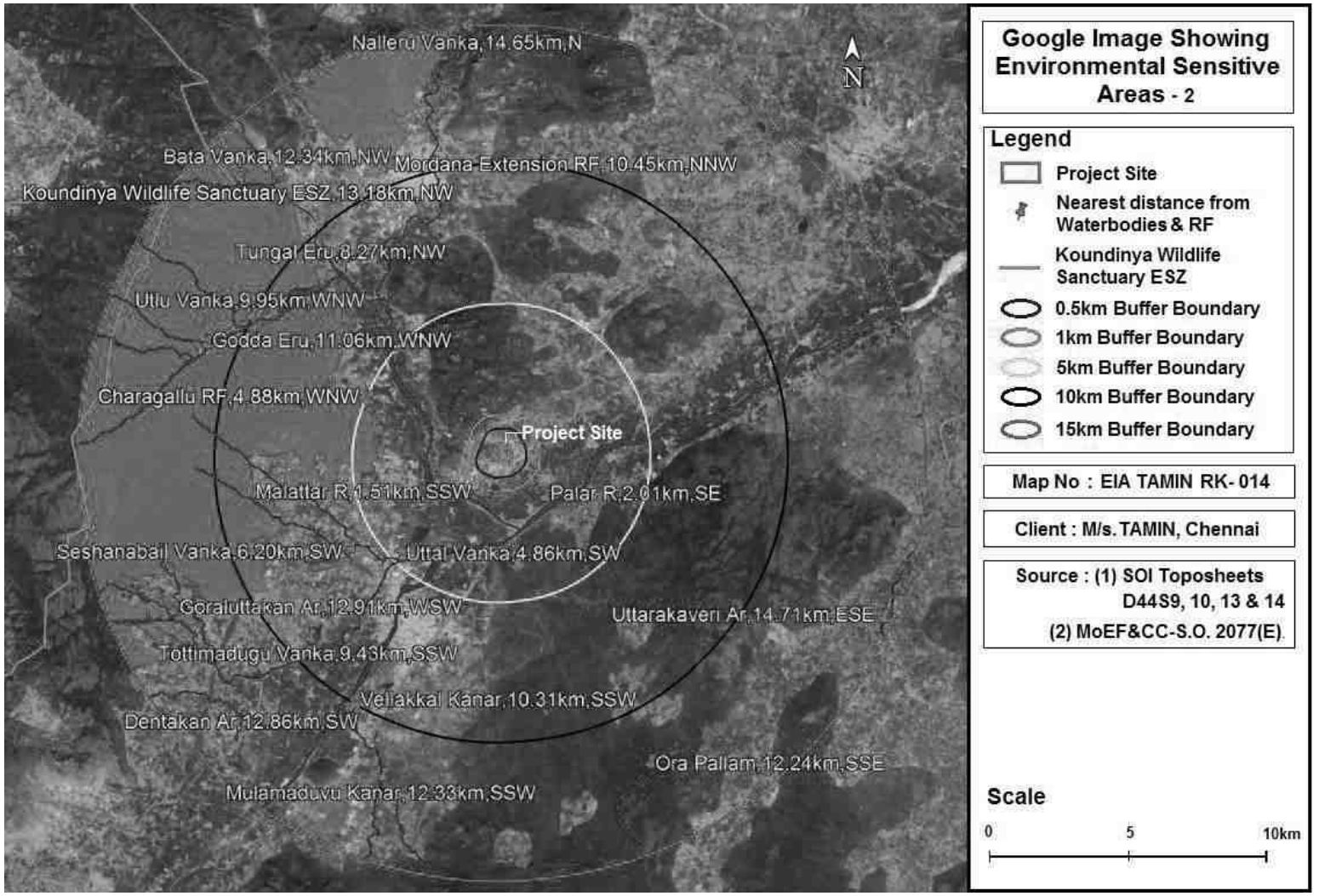



**Figure 3-4 (b) Environmental sensitive areas covering within 15 km from project boundary**

## 3.5 Physical Conditions

In this section, the physical conditions of PIA district are discussed in general and wherever possible references to the conditions prevailing in the study area in particular are also provided. The physical conditions are discussed as under:

- District profile
- Drainage, land use, geology, Physiography
- Natural resources
- Climatic conditions, seismic zone characteristics and natural hazard

### 3.5.1 PIA District Profile

The district is spread over between 12° 15' and 13° 15' of North latitude and 78° 20' and 79° 50' of East longitude.Vellore district is situated in the northern part of Tamil Nadu bordering Andra Pradesh. The district bounded by Andra Pradesh on the north, Thiruvallur district on the northeast, Kancheepuram district on the east, Tiruvannamalai district on the south and Krishnagiri district on the West. The total geographical area of the district is 6075 sq.kms. In terms of size, Vellore district ranked 4th in comparision to other district in the State.

***Source:***

https://censusindia.gov.in/2011census/dchb/DCHB_A/33/3304_PART_A_DCHB_VELLORE.pdf

*(**Ref:**Directorate of Census Operations Tamil Nadu, "District Census Handbook 2011, Vellore District", Series-34, Part XII-A)*

***Note:** Ranipet district was a part of Vellore district before the bifurcation on 28th November 2019. Since secondary sources are available only for Vellore district, however Vellore district comprises Ranipet district details before bifurcation.*

### 3.5.2 Climatic Conditions

Moderate climate is recorded in the district. Better climate has been recorded in the areas where more forest cover and hilly region. The maximum temperature of Vellore in 2009- 10 was 40.4°C in April and minimum temperature was 18.5°C in January. In 2009-10, Vellore district received 814.8mm of rainfall as compared to a normal of 917mm. This district gets maximum rainfall (251.7mm) in September (South West Monsoon) and minimum rainfall (0.0mm) in February and March (winter and Hot Weather).

***Source:***

https://censusindia.gov.in/2011census/dchb/DCHB_A/33/3304_PART_A_DCHB_VELLORE.pdf

*(**Ref:**Directorate of Census Operations Tamil Nadu, "District Census Handbook 2011, Vellore District", Series-34, Part XII-A)*

***Note:*** *Ranipet district was a part of Vellore district before the bifurcation on 28th November 2019. Since secondary sources are available only for Vellore district, however Vellore district comprises Ranipet district details before bifurcation.*

### 3.5.3 Natural Resources of Vellore District

**Flora & Fauna**

Ordinary plants such as tamarind, teakwood, sandal wood, ven-teak, casuarina, bamboo etc are common in the forests. Bison, tiger, Black bears, hyenas, sambar, spotted deer, jungle sheep, barking deer, antelope,king cobras, Monkeys exist in several places in the district. The most common birds of South Indian species are seen in the district.

***Source:***

https://censusindia.gov.in/2011census/dchb/DCHB_A/33/3304_PART_A_DCHB_VELLORE.pdf

*(**Ref:**Directorate of Census Operations Tamil Nadu, "District Census Handbook 2011, Vellore District", Series-34, Part XII-A)*

***Note:*** *Ranipet district was a part of Vellore district before the bifurcation on 28th November 2019. Since secondary sources are available only for Vellore district, however Vellore district comprises Ranipet district details before bifurcation.*

### 3.5.4 Forest Resources

Dense forest is found in many mountain ranges of Jawadhu region. Many forest areas have been classified as Reserve Forest in Gudiyatham, Katpadi, Wallajah, Arakonam, Arcot, Vellore, Vaniyambadi, Ambur and Tirupathur taluks.

***Source:***

https://censusindia.gov.in/2011census/dchb/DCHB_A/33/3304_PART_A_DCHB_VELLORE.pdf

*(**Ref:**Directorate of Census Operations Tamil Nadu, "District Census Handbook 2011, Vellore District", Series-34, Part XII-A)*

***Note:*** *Ranipet district was a part of Vellore district before the bifurcation on 28th November 2019. Since secondary sources are available only for Vellore district, however Vellore district comprises Ranipet district details before bifurcation.*

### 3.5.5 Irrigation

Irrigation sources in the district are poor and the agriculture depends on seasonal rainfall. Tube wells and dug wells are cheif sources of irrigation. The rivers Palar, Ponnai and the Pennai River meet a good part of the irrigational needs and "anaicuts" have been constructed across them. The three important anaicuts are built across Palar, Ponnai and Pennaiyar. The Palar anaicut irrigates land in Wallajah and Arakonam taluks. The anaicut across PonnaiRiver also irrigates smaller area in these taluks. For irrigation of agricultural lands, there were 604 canals and 110,220 wells (for irrigation only) besides 57,055 wells used for domestic purposes in 2009-10. There were 1355 tanks in the district; out of this 420 have ayacuts of 40 hectares or more while remaining tanks have ayacuts of less than 40 hectares. KaveripakkamLake,

covering an area of 6 sq. kms, is a major tank in the district which irrigates large area of land. The water from the lake, when ever it is filled, irrigates land in 33 villages. Depending on water availability, the cultivation is done in 2-3 times a year.

***Source:***

https://censusindia.gov.in/2011census/dchb/DCHB_A/33/3304_PART_A_DCHB_VELLORE.pdf

*(**Ref:**Directorate of Census Operations Tamil Nadu, "District Census Handbook 2011, Vellore District", Series-34, Part XII-A)*

***Note:** Ranipet district was a part of Vellore district before the bifurcation on 28th November 2019. Since secondary sources are available only for Vellore district, however Vellore district comprises Ranipet district details before bifurcation.*

### 3.5.6 Agricultural Resources

Paddy, Millets Cholam, Cumbu, Ragi, Maize, Pulses like Redgram, Blackgram, Greengram, and Oilseeds like Groundnut, other crops Sugarcane and cotton are cultivated predominantly in Ranipet District. Paddy, which is the staple food crop of Tamil Nadu is extensively cultivated in Ranipet District in a normal area of 42, 900 Ha. And it is cultivated in three major seasons viz., Sornavari (Apr – July), Samba (Aug – Nov) and Navarai (Dec – Mar). Pulses are a remunerative crop that enables the farmers to fetch higher income. In Ranipet, pulses is raised in a normal area of 30,000 Hectares of which redgram occupies major area followed by horse gram, black gram, green gram. Strategies such as promotion of pulses as pure crop, intercrop, bund crop besides encouraging the farmers to practice rice fallow pulses coupled with micro-irrigation units such as sprinklers and rainguns are adopted.

***Source:*** https://ranipet.nic.in/agriculture/

*(**Ref:** Profile of Ranipet District-Government of Tamil Nadu)*

### 3.5.7 Mineral Resources

Vellore District in Tamil Nadu accounts for 79% of country's resources of vermiculite (source: IBM - Indian Minerals year book 2016) with a single operating mine producing 989 tonnes in 2015-16 valued for 2218 million rupees. In addition to Granites (Dimension stones) and River Sand with minor occurrence of other minerals such as Fireclay, Graphite, Limestone, Quartz/Silica sand, Apatite, Barytes, Molybdenum, etc., excluding Atomic and Rare Earth Minerals. Geology and Minerals Maps of Tamilnadu and Pondicherry is shown in **Figure 3.5**.

***Source:***

https://cdn.s3waas.gov.in/s31651cf0d2f737d7adeab84d339dbabd3/uploads/2019/04/2019040961.pdf

*(**Ref:**District Survey Report-Vellore District-Department of Geology and Mining-Government of Tamil Nadu)*

***Note:*** *Ranipet district was a part of Vellore district before the bifurcation on 28th November 2019. Since secondary sources are available only for Vellore district, however Vellore district comprises Ranipet district details before bifurcation.*

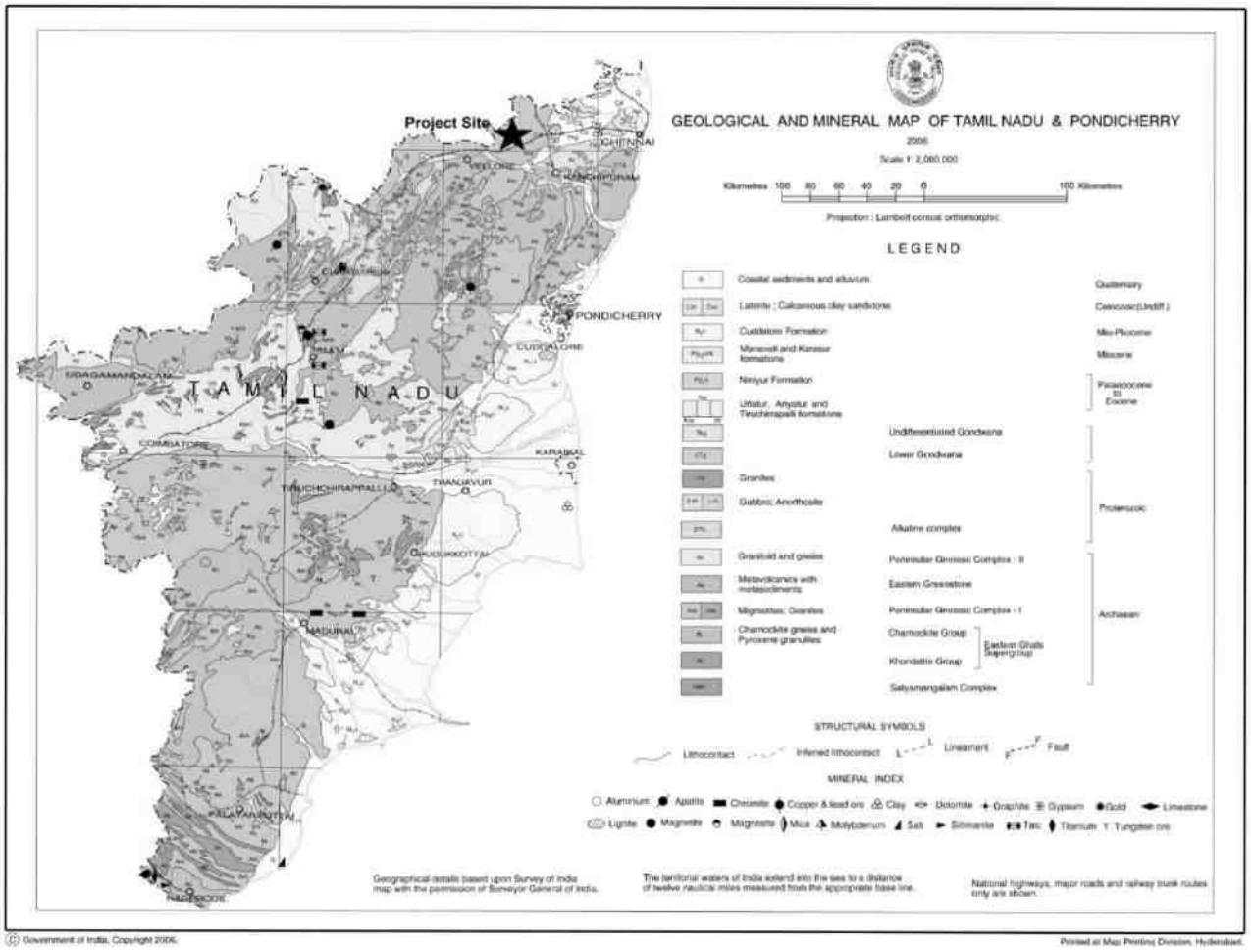



**Figure 3-5 Geology and Minerals Maps of Tamil Nadu and Pondicherry**

### 3.5.8 Land Use & Land Cover

Total geographical area of Vellore district is 6077 sq. km. Details of land use/land cover statistics for Vellore district is given in Table 3.3. Land use/Land cover map of the Vellore district is shown in **Figure 3.6**. Land Use Pattern of Vellore district **Figure 3.7.**

**Table 3-2 District land use/land cover statistics (2011-12) for Vellore district**

| S. No | Particulars | Area (sq.km) | Area (Hectares) | Area (Acres) | Percent age |
|---|---|---|---|---|---|
| 1. | Built up, Urban | 118.47 | 29274.53 | 11847 | 1.95 |
| 2. | Buildup , Rural | 260.08 | 64267.07 | 26008 | 4.28 |
| 3. | Buildup , mining | 16.48 | 4072.29 | 1648 | 0.27 |
| 4. | Agriculture crop land | 2149.38 | 531122.54 | 214938 | 35.37 |
| 5. | Agriculture plantation | 807.24 | 199473.04 | 80724 | 13.28 |
| 6. | Agriculture Fallow | 717.31 | 177250.89 | 71731 | 11.80 |
| 7. | Forest ,Evergreen /semi evergreen | 234.13 | 57854.69 | 23413 | 3.85 |
| 8. | Forest deciduous | 1126.36 | 278329.19 | 112636 | 18.53 |
| 9. | Forest, Forest plantation | 12.79 | 3160.47 | 1279 | 0.21 |
| 10. | Forest scrub forest | 0.37 | 91.43 | 37 | 0.01 |
| 11. | Barren/unculturable/wastelands/ Salt Affected land | 2.99 | 738.84 | 299 | 0.05 |
| 12. | Barren/unculturable/wastelands/ Gullied /Ravinous Land | 0.08 | 19.77 | 8 | 0.00 |
| 13. | Bareen/unculturable/wastelands, scrub Land | 207.91 | 51375.60 | 20791 | 3.42 |
| 14. | Barren /unculturable /wastelands , sandy lands | 0.68 | 168.03 | 68 | 0.01 |
| 15. | Barren/unculturable/wastelands,Barren rocky | 11.97 | 2957.85 | 1197 | 0.20 |
| 16. | Wetlands/water Bodies, Rivers / Stream/canals | 112.34 | 27759.78 | 11234 | 1.85 |
| 17. | Wetland/Water Bodies/Reservoir/Lakes/ponds | 298.44 | 73746.02 | 29844 | 4.91 |
| | **Total** | **6077.0** | **1501662.03** | **607702** | **100.00** |

***Note:*** *Ranipet district was a part of Vellore district before the bifurcation on 28th November 2019. Since secondary sources are available only for Vellore district, however Vellore district comprises Ranipet district details before bifurcation.*

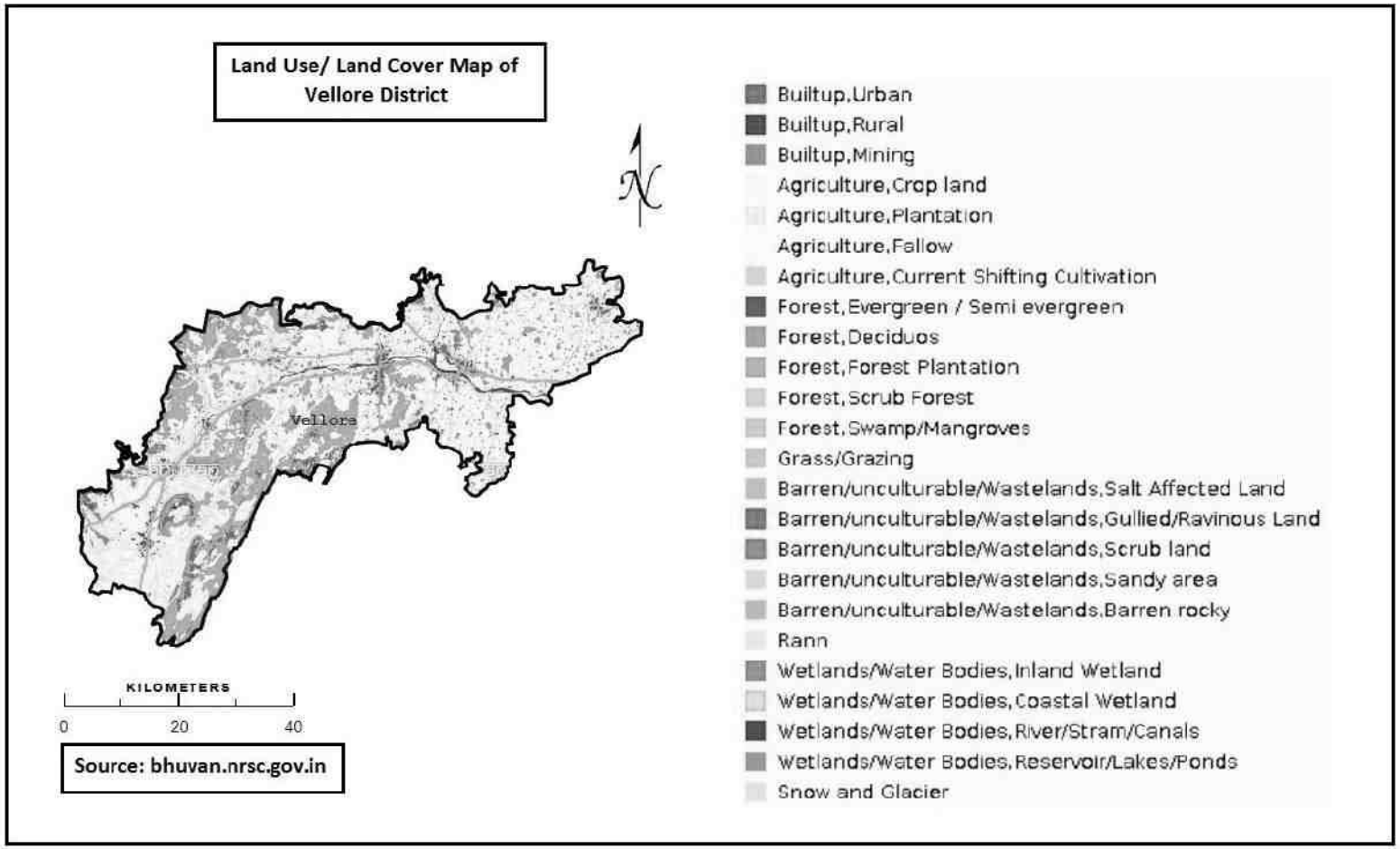



**Figure 3-6 Land use/Land cover map of the Vellore district**

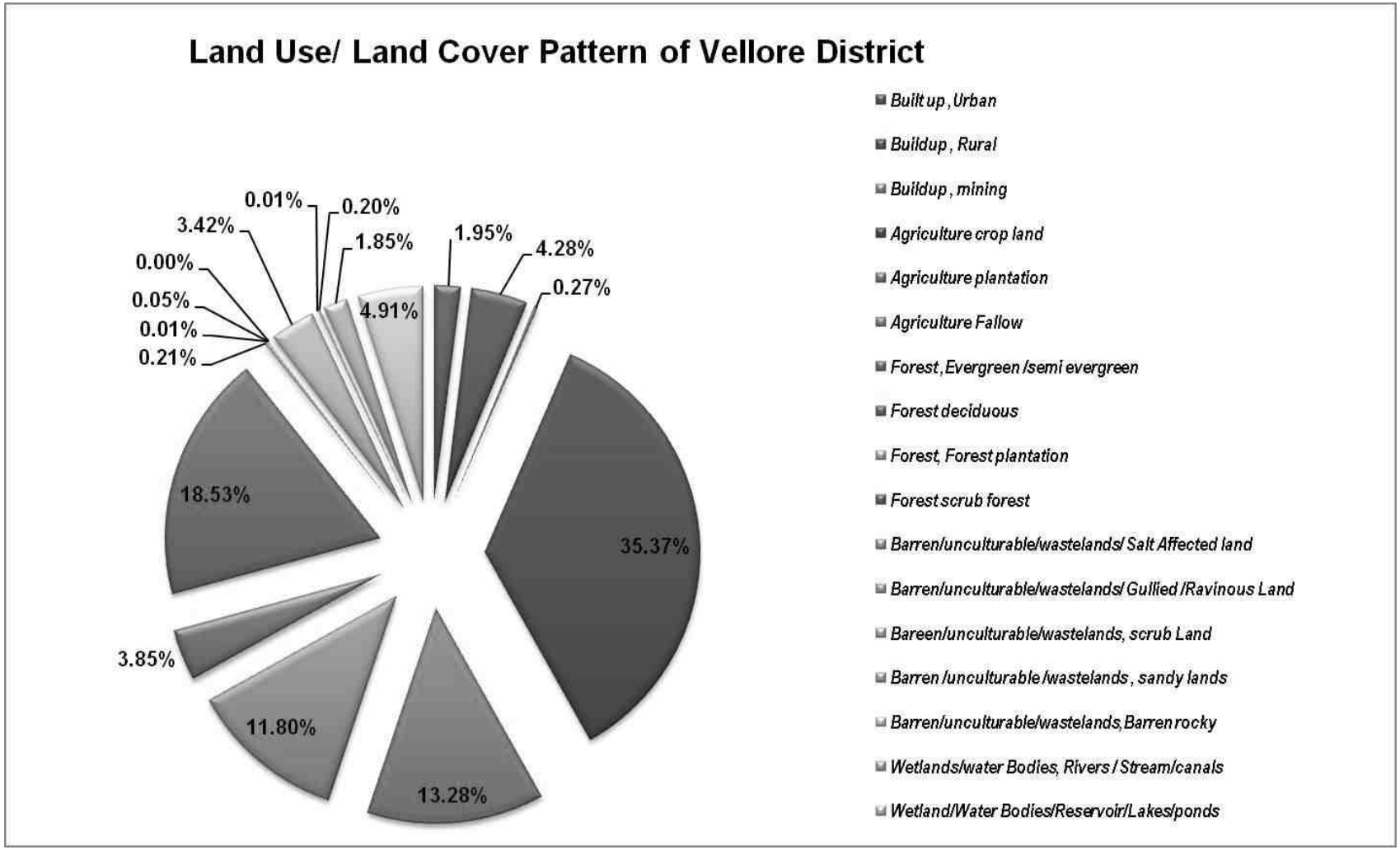



**Figure 3-7Land Use/Land Cover Pattern of Vellore district**

### 3.5.9 Land use land cover for the study area

Total Project Study Area is **341.94** Sq.Km. Land Use /Land Cover pattern of the Study Area and Land Use /Land Cover map of the Study Area is given in **Figure 3.8** and **Figure 3.9** respectively. The land use/ land cover pattern of the study area is given in **Table 3-3.**

**Table 3-3 Land use/ Land Cover pattern of the Study Area**

| S. No | Description | Area (sq.km) | Area (Acres) | Area (Hectares) | Area (%) |
|---|---|---|---|---|---|
| 1. | Deciduous | 94.75 | 23413.20 | 9475 | 27.71 |
| 2. | Plantation | 89.22 | 22046.71 | 8922 | 26.09 |
| 3. | Fallow | 77.95 | 19261.83 | 7795 | 22.80 |
| 4. | Crop land | 19.74 | 4877.85 | 1974 | 5.77 |
| 5. | Evergreen / Semi Evergreen | 16.91 | 4178.55 | 1691 | 4.95 |
| 6. | Rural | 12.15 | 3002.33 | 1215 | 3.55 |
| 7. | Urban | 9.46 | 2337.61 | 946 | 2.77 |
| 8. | River / Stream / Canals | 8.52 | 2105.33 | 852 | 2.49 |
| 9. | Scrub land | 7.12 | 1759.39 | 712 | 2.08 |
| 10. | Barren rocky | 2.77 | 684.48 | 277 | 0.81 |
| 11. | Waterbodies | 2.25 | 555.99 | 225 | 0.66 |
| 12. | Mining | 0.74 | 182.86 | 74 | 0.22 |
| 13. | Forest Plantation | 0.36 | 88.96 | 36 | 0.11 |
| | **Total** | **341.94** | **84495.08** | **34194** | **100.00** |

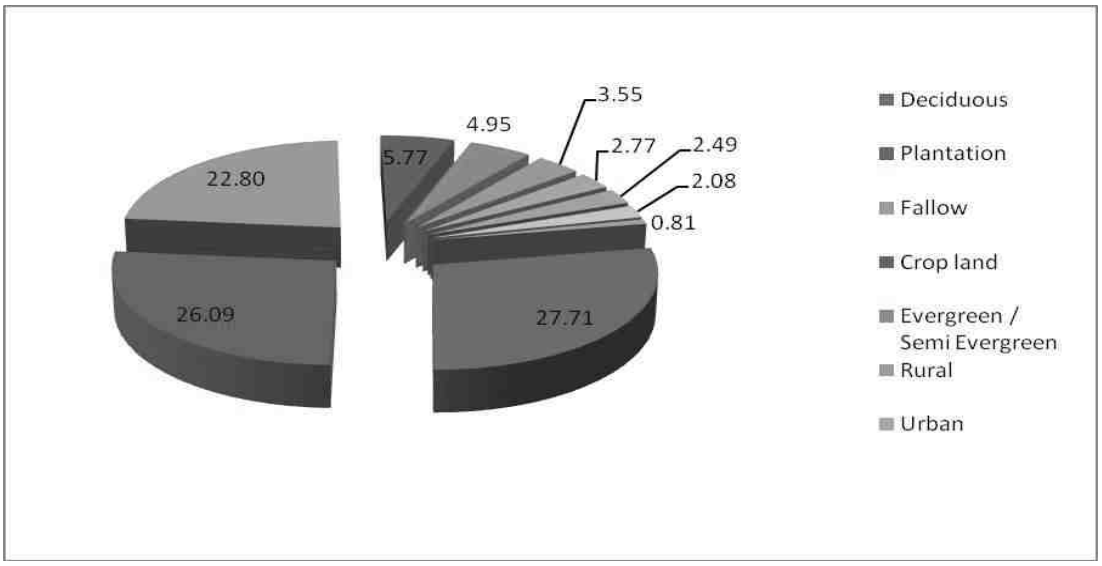



**Figure 3-8 Land use/ Land Cover pattern of the Study Area**

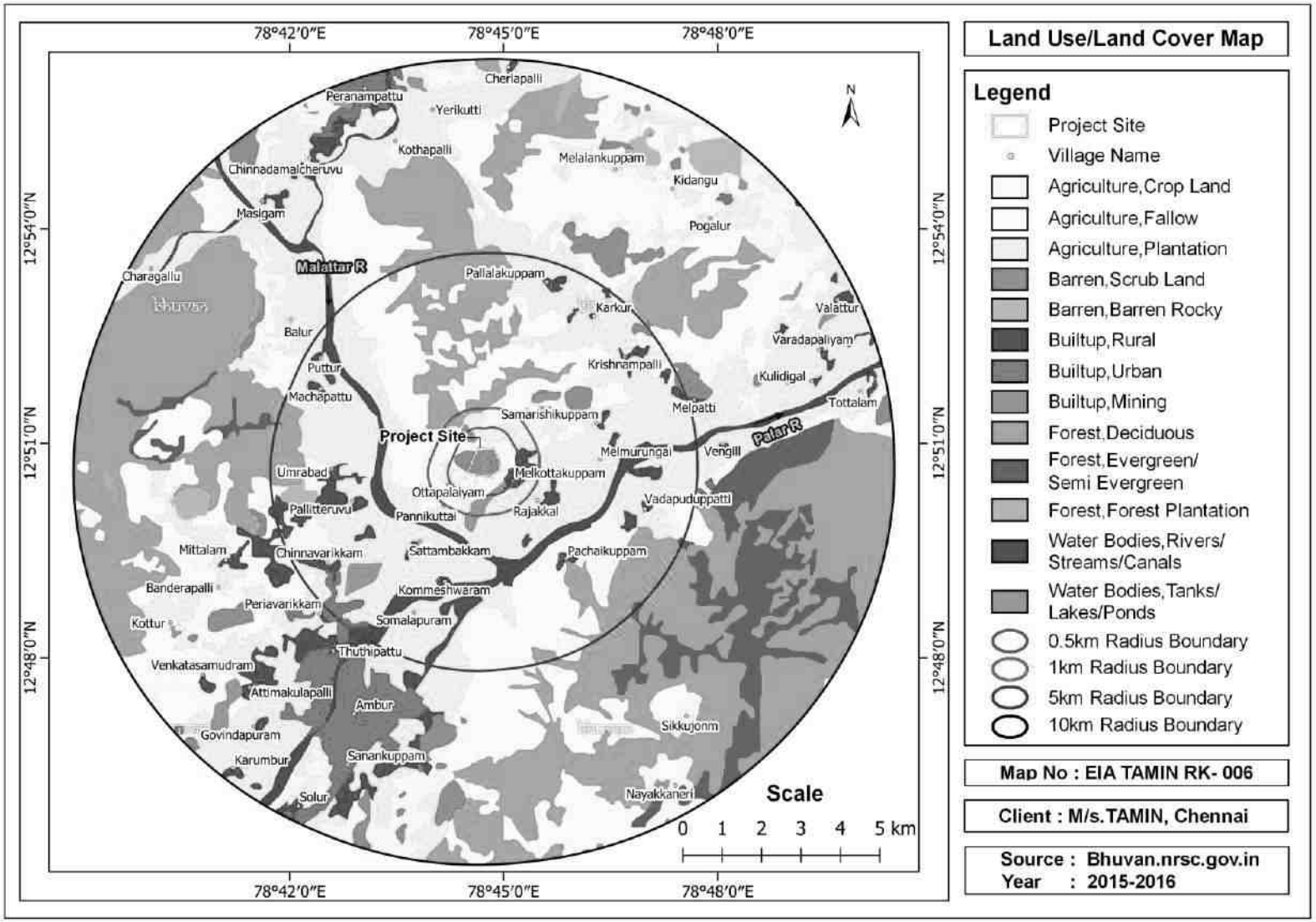



**Figure 3-9 Land use/ land cover map of the Study Area**

### 3.5.10 Topography

Vellore district can be classified into two major physiographic divisions i) Hilly terrain in the eastern and southwestern parts ii) Plain regions in the eastern part. The western part of the district is occupied by the Javadi and Elagiri hills. In the Elagiri hills, a few peaks 1121m, 942m, 841m raise above, are prominent. In Javadi hills, the peaks 1076m, 975m and 99m are prominent. The eastern areas of Vellore are undulating rugged plains with isolated hillocks of 120m and 140m above msl. The area is drained by Palar, Cheyyar and smaller distributary streams. The drainage is subdendritic and most of the streams are ephemeral. The Palar Flood Plain becomes broader on entering into the Kancheepuram district whereas in the west, it is restricted to the river bed only. The south western part of the district viz., Elagiri hills ranging upto 1330 m above mean sea level. The lowest of 21m at the eastern margin of the district in the alluvial plains of Palar River.

***Source:***
https://cdn.s3waas.gov.in/s31651cf0d2f737d7adeab84d339dbabd3/uploads/2019/04/2019040961.pdf
*(**Ref:** District Survey Report-Vellore District-Department of Geology and Mining-Government of Tamil Nadu)*

***Note:** Ranipet district was a part of Vellore district before the bifurcation on 28th November 2019. Since secondary sources are available only for Vellore district, however Vellore district comprises Ranipet district details before bifurcation.*

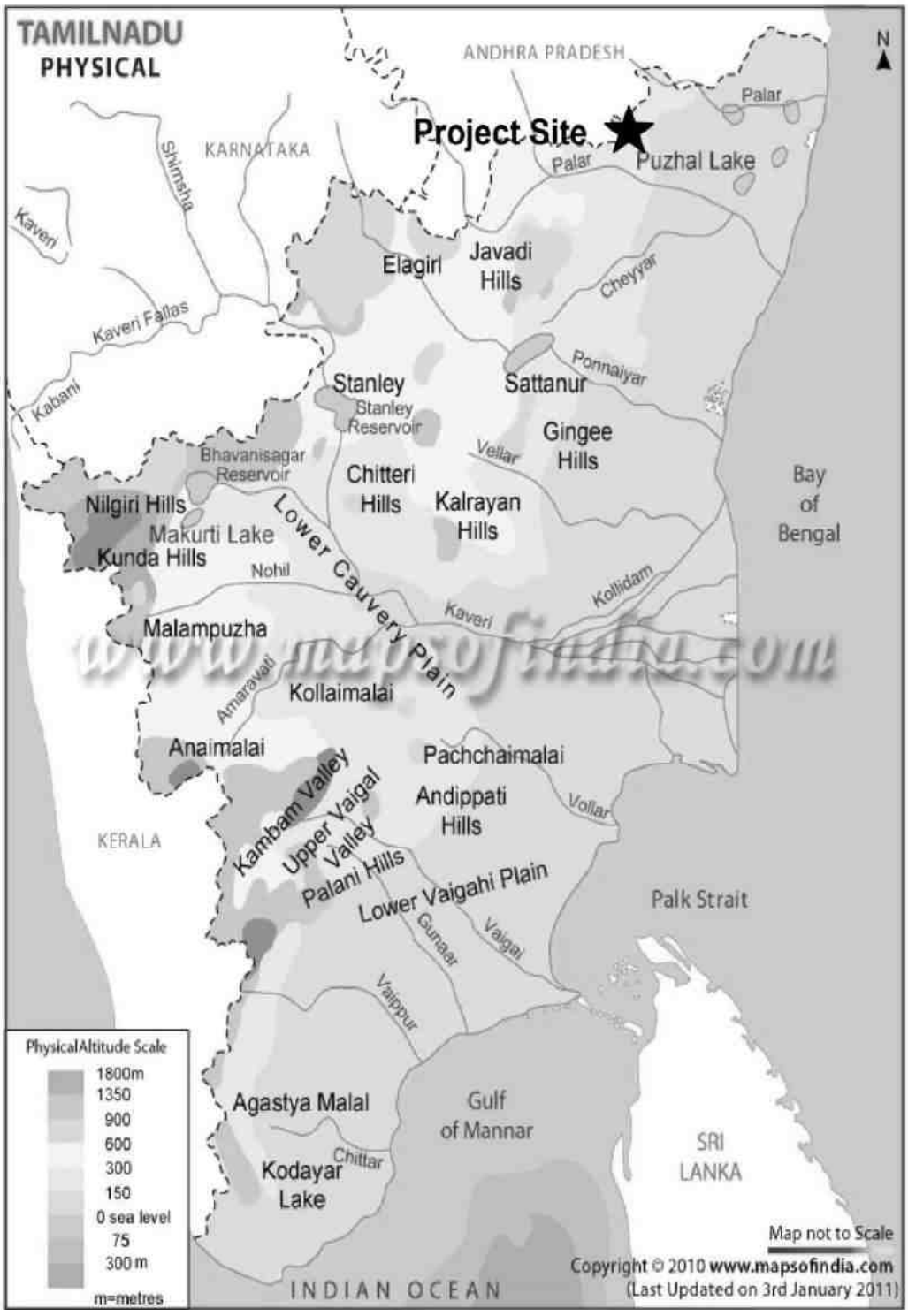



**Figure 3-10 Physical map of Tamil Nadu State**

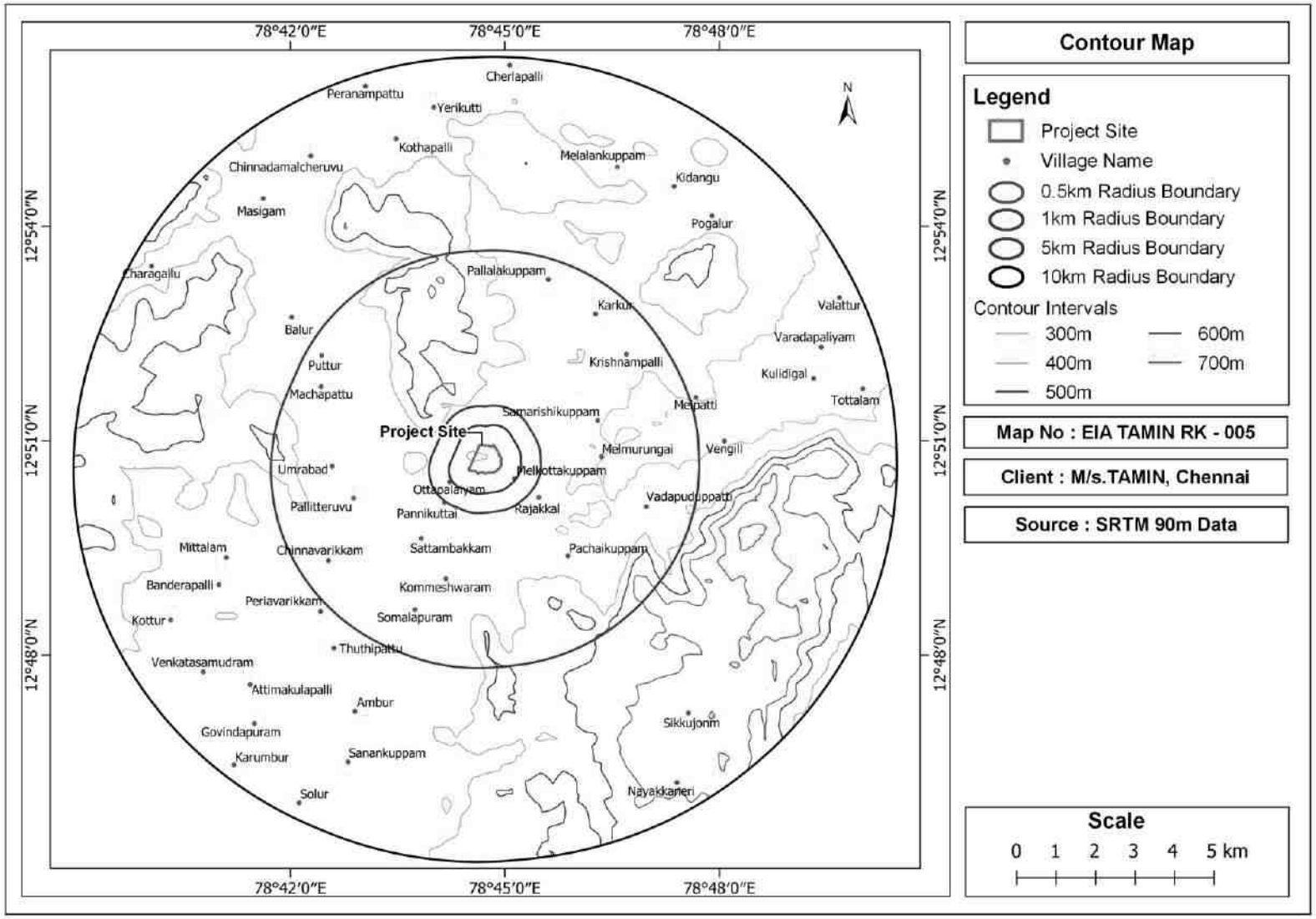



**Figure 3-11 Contour map of Study Area**

### 3.5.11 Geomorphology of PIA District

Vellore district can be classified into two major physiographic divisions viz., i) Hilly terrain in the eastern and southwestern parts and ii) Plain regions in the eastern part. The landscape in the hilly terrain is undulating to rugged, flanked by hill ranges belonging to Eastern Ghats. The major hill ranges in the district are those belonging to Jawadu, Elagiri and Kalrayan hills. The eastern part of the district is a gently undulating plain dotted with isolated hillocks with sharply rising peaks, sloping towards east.

***Source:*** http://cgwb.gov.in/District_Profile/TamilNadu/Vellore.pdf
*(**Ref:** District Groundwater Brochure-Vellore District-Central Ground Water Board-January 2009)*

***Note:****Ranipet district was a part of Vellore district before the bifurcation on 28th November 2019. Since secondary sources are available only for Vellore district, however Vellore district comprises Ranipet district details before bifurcation.*

### 3.5.12 Geomorphology of the Study Area

Geomorphology of the study area consists of Denudational origin - pediment – pedi plain Complex-33.17%, Structural Origin-Moderately Dissected Hills and Valleys –32.32% and Fluvial Origin-Active Flood Plain – 15.3%. The total Geographical area of the study area is **341.94sq.km**. The Geomorphology of the study area is given in **Table 3-4.** Geomorphology pattern of the study area is given in **Figure 3.12.** Geomorphology map of study area is given in **Figure 3.13.**

**Table 3-4 Geomorphology of the study area**

| S. No. | Geomorphology | Area in sq.km | Area in Acre | Area in Hectare | Total Area % |
|---|---|---|---|---|---|
| 1. | Denudational Origin-Pediment-PediPlain Complex | 113.41 | 28024.20 | 11341 | 33.17 |
| 2. | Structural Origin-Moderately Dissected Hills and Valleys | 110.52 | 27311.16 | 11052 | 32.32 |
| 3. | Fluvial Origin-Active Flood Plain | 52.32 | 12929.40 | 5232 | 15.30 |
| 4. | Denudational Origin-Moderately Dissected Hills and Valleys | 50.09 | 12377.24 | 5009 | 14.65 |
| 5. | Waterbodies | 10.61 | 2621.53 | 1061 | 3.10 |
| 6. | Structural Origin-Low Dissected Hills and Valleys | 3.09 | 762.93 | 309 | 0.90 |
| 7. | Denudational Origin-Low Dissected Hills and Valleys | 1.71 | 421.47 | 171 | 0.50 |
| 8. | Fluvial Origin-Bajada | 0.19 | 47.17 | 19 | 0.06 |
| | **Total** | **341.94** | **84495.08** | **34194** | **100.00** |

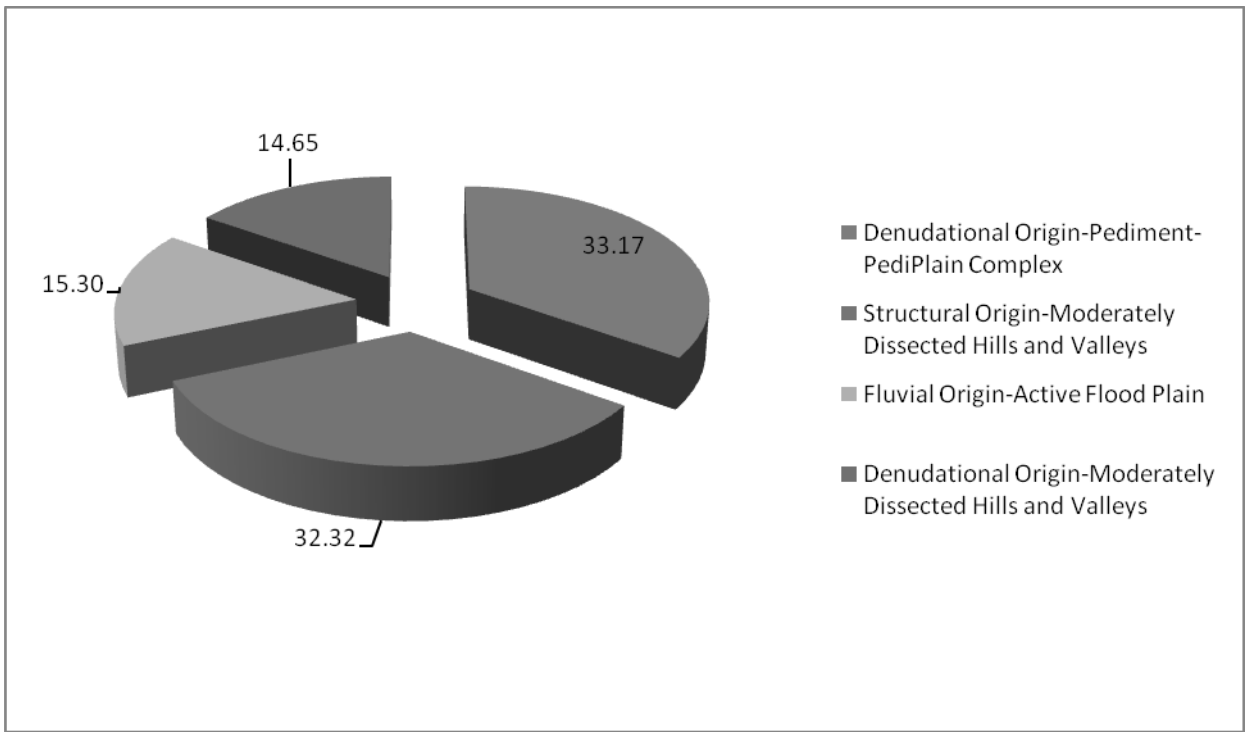



**Figure 3-12 Geomorphology Pattern of the Study Area**

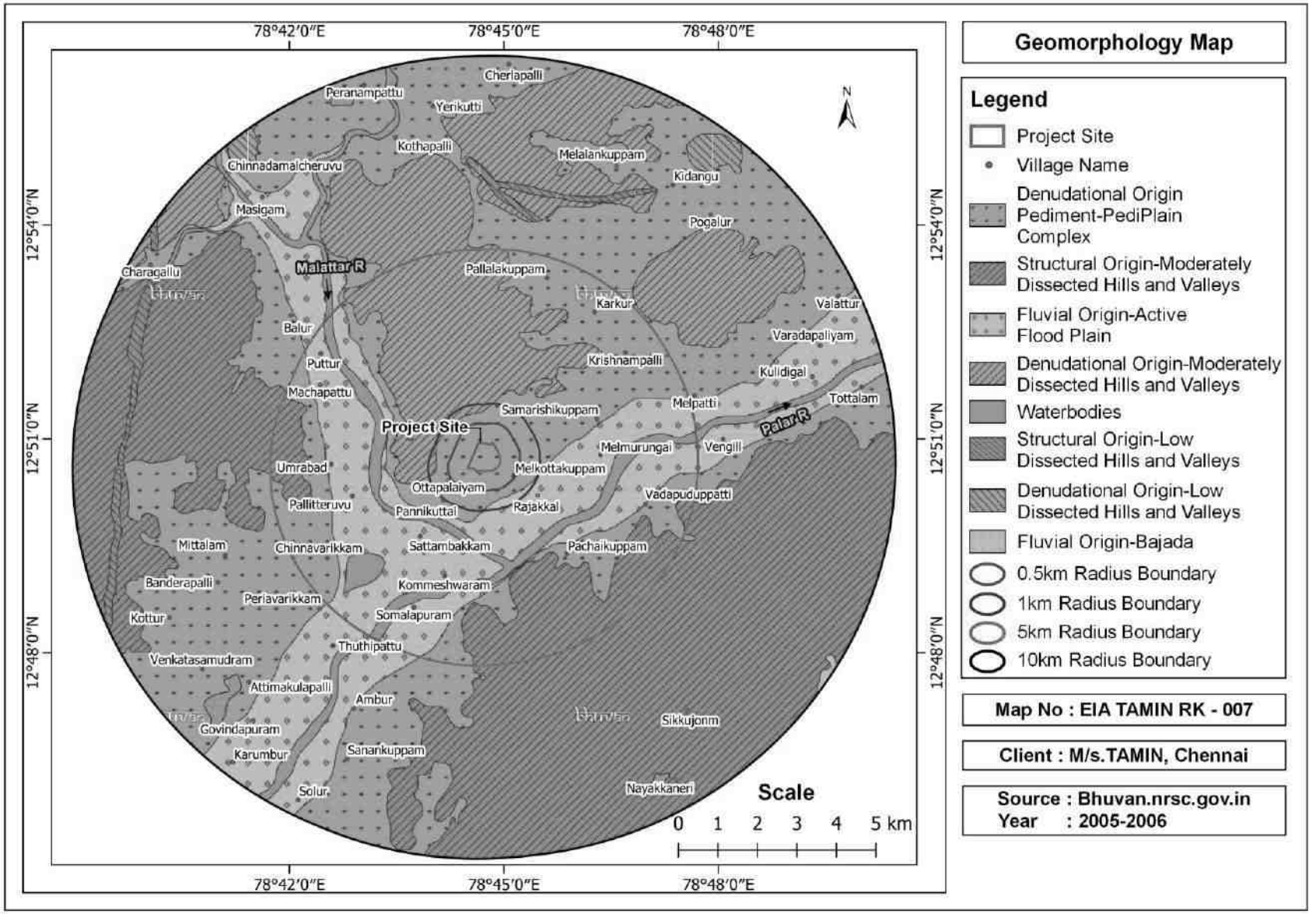



**Figure 3-13 Geomorphology Map of Study Area**

### 3.5.13 Hydrogeology of PIA District

Vellore district is underlain by geological formations ranging in age from Archaean to Recent. In the crystalline formations comprising charnockites, gneisses and granites. The yield of dug wells is less than <1 lps in massive crystalline rocks whereas it is up to 2.3 lps in highly weathered gneisses. The specific capacity of wells tested in the district ranged from 18.82 to 80.58 lpm/m/dd. The yield of exploratory wells drilled in crystalline rock areas of the district ranged from 0.27 to 10.55 lps. The specific capacity of bore wells ranged from 0.738 to 23.41 lps/m/dd. While the exploratory wells in alluvium have yields in the range of 3 – 7 lps. During May 2006, the depth to water levels in observation wells tapping shallow aquifer ranged from 1.15 – 18.60 m bgl. Shallow ground water levels i.e. less than 5 m bgl were prominently observed in observation wells at Arcot, Girisamudram, Rangavaram, Ranipet and Vishram, and comparatively deeper ground water levels (10 – 20 m bgl) at Asanampatti, Kandhili, K.V.Kuppam, Madhanur, Paradarami, Thirupathur and Thimiri. Depth to ground water levels during January 2007 ranged from 1 to 18.45 m bgl. Water levels were within 2 m bgl in isolated pockets in Echipudur and Ranipet and resulted in localised seasonal water logging conditions. Deeper ground water levels (10 – 20 m bgl) still persisted in the pockets of Asanampattu, Kandhili, K.V.Kuppam, Madhanur, Paradarami-I, Pernambut, Thirupathur and Thimiri. The depth to piezometric surface of the deeper fractured aquifers ranged from 3.78 – 21.70 m bgl during pre monsoon and 2.08 to 8.02 m bgl during post monsoon period. Hydrogeology map of the PIA district is given in **Figure 3.14.**

***Source:***http://cgwb.gov.in/District_Profile/TamilNadu/Vellore.pdf
*(**Ref:** District Groundwater Brochure-Vellore District-Central Ground Water Board-January 2009)*

***Note:****Ranipet district was a part of Vellore district before the bifurcation on 28th November 2019. Since secondary sources are available only for Vellore district, however Vellore district comprises Ranipet district details before bifurcation.*

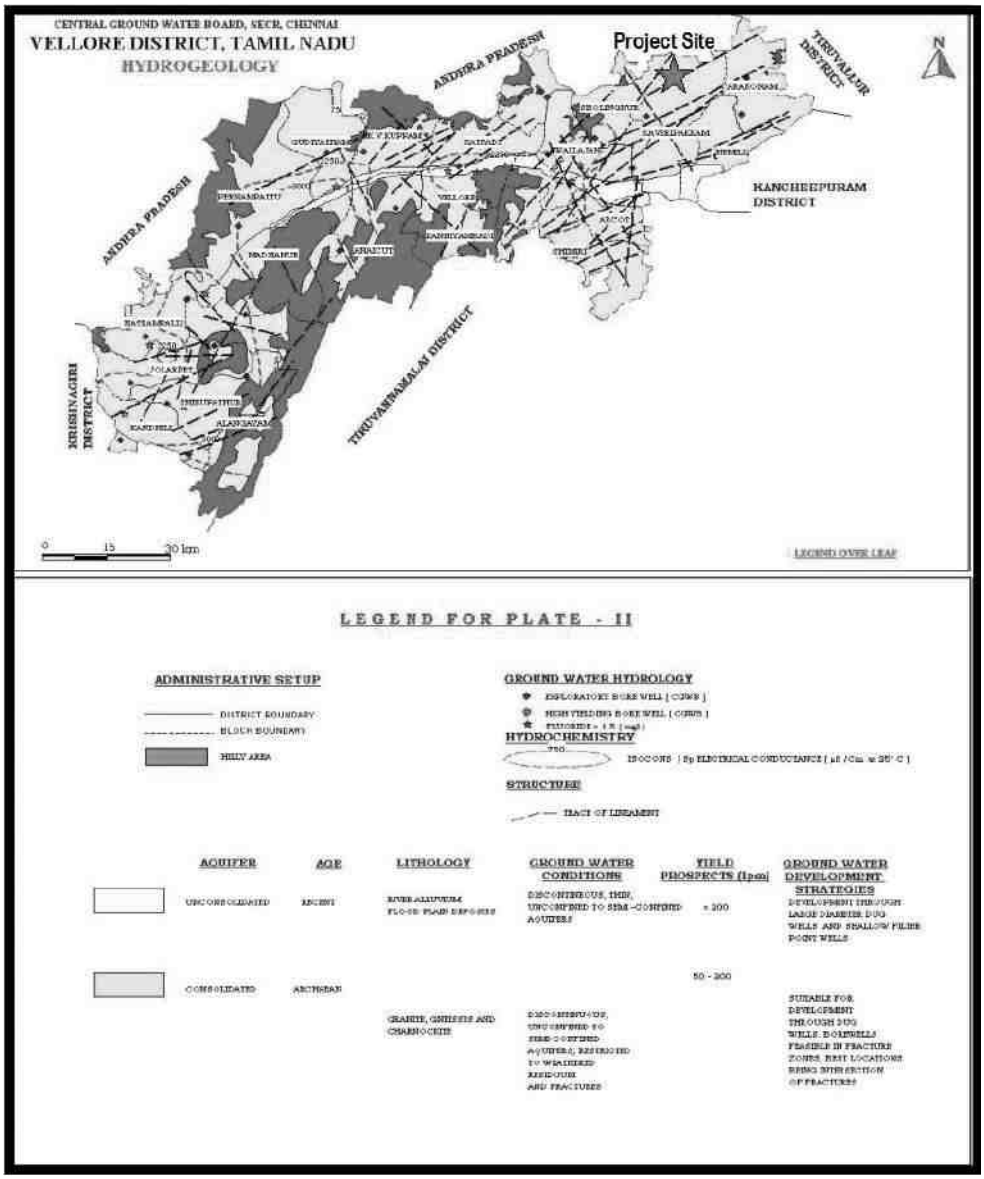



**Figure 3-14 Hydrogeology map of the PIA district**

### 3.5.14 Drainage Pattern in PIA District

Rivers such as Palar, Ponnai, Pamban, Malattar, Kavundinyanadi, Agaram Aru, Kallar, Naganadi and Goddar are imporatnt but not useful irrigation as they mostly dry and sand wastes except heavy rain seasons. Originating near Nandidurg in Karnataka, Palar river enters the district in the western part through Vaniyambadi taluk. It is an important river in the district. Running towards east crossing Gudiyatham taluk, the river forms the boundary between Vaniyambadi, Gudiyatham and Vellore taluks. Making boundary between Wallajah and Arcot taluks, and separating Arcot and Ranipet towns PalarRiver enter into Cheyyar taluk in Tiruvannamalai district on the east. PonnaiRiver rising in Chittoor district of Andhra Pradesh flows on the western part of Walajapet taluk and joins Palar near Ranipet. Other rivers

such as Goddar and Kavundinyanadi originating from north to south in Gudiyatham flows in to Palar river.Drainage map of the study area is given in **Figure 3.15.**

***Source:***

https://censusindia.gov.in/2011census/dchb/DCHB_A/33/3304_PART_A_DCHB_VELLORE.pdf

*(**Ref:**Directorate of Census Operations Tamil Nadu, "District Census Handbook 2011, Vellore District", Series-34, Part XII-A)*

***Note:** Ranipet district was a part of Vellore district before the bifurcation on 28th November 2019. Since secondary sources are available only for Vellore district, however Vellore district comprises Ranipet district details before bifurcation.*

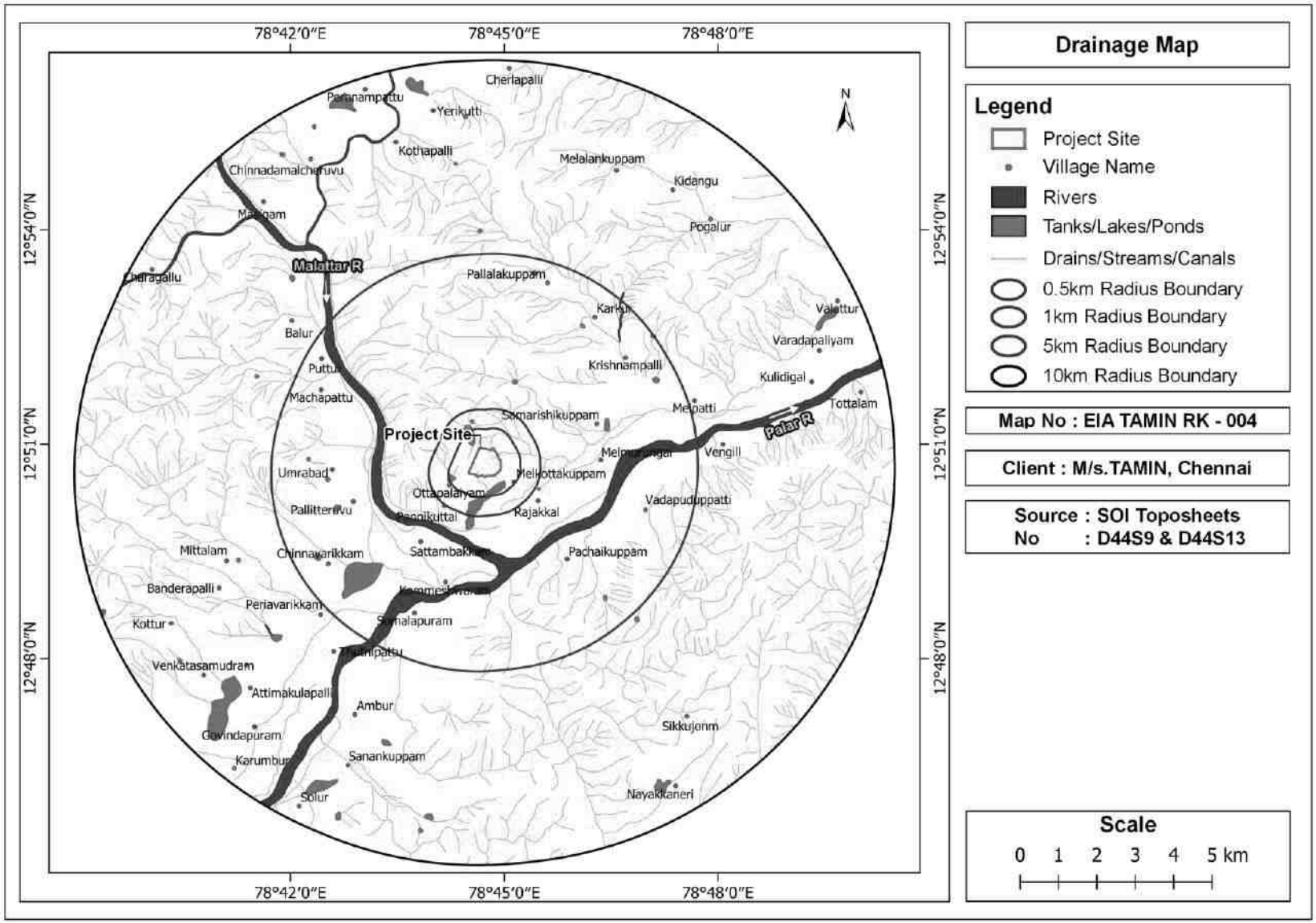



**Figure 3-15 Drainage map of the study area**

### 3.5.15 Soils in PIA District

Containing complex mineral compounds, the soil is thin layer of earth's crust made up of disintegrated and decomposed rocks. It constituted with the natural resources which supports to the growth of plants on earth. The central and southern parts of the district are mostly hilly and the eastern portion is almost a stretch of unbroken plain. In the western part, the land rises gradually towards the Mysore plateau along the Chittoor district. The soil is mostly of the red ferruginous variety both sandy and loamy, with black area accounting for about 16%. The black soil is found mostly in the neighbourhood of the rivers of Palar, Ponnai and in the ayacuts of a few big tanks. The black soil occurs in Arakonam, Wallajah, Arcot and Tirupathur Taluks. The black type loam soil is found mostly in Arakonam and Gudiyatham taluks in larger areas than in other taluks while red loam soil is found in all the taluks.

***Source:***

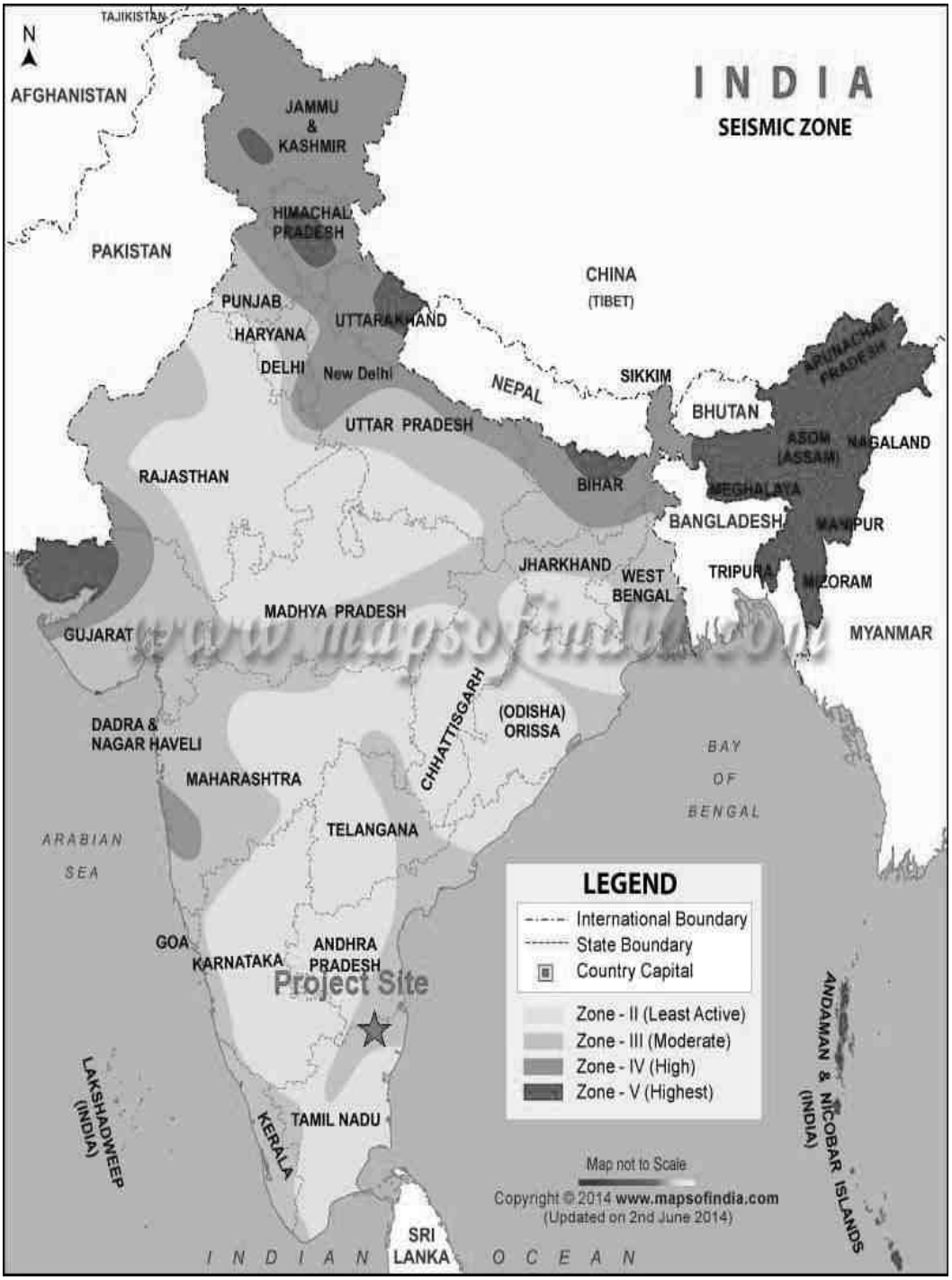
https://censusindia.gov.in/2011census/dchb/DCHB_A/33/3304_PART_A_DCHB_VELLORE.pdf

*(**Ref:** Directorate of Census Operations Tamil Nadu, "District Census Handbook 2011, Vellore District", Series-34, Part XII-A)*

***Note:** Ranipet district was a part of Vellore district before the bifurcation on 28th November 2019. Since secondary sources are available only for Vellore district, however Vellore district comprises Ranipet district details before bifurcation.*

### 3.5.16 Seismicity

As per the IS:1893 (Part-1) 2002 of Bureau of Indian Standards (BIS), the project location/study area falls in semi-arid region and the climate of the area is generally hot. The project location/study area falls in Zone III, which is categorized as a Moderate Risk Zone. The seismicity map of India is shown in **Figure 3.16.**




*(Source: Mapsof India)*

**Figure 3-16 Seismicity Map of India**

## 3.6 Air Environment

Baseline ambient air quality assessment gives the status in the vicinity of site and is an indispensable part of environmental impact assessment studies. Significant changes, in predominant winds and weather conditions are observed in winter, summer and post-monsoon seasons apart from the local topographic influences. The baseline status of air environment in the study area is assessed through a systematic air quality surveillance programme.

### 3.6.1 Meteorological Conditions

The regional air quality is influenced by the meteorology of that region. The principal weather parameters that influence the concentration of the air pollutants in the surroundings are wind speed, wind direction and temperature. The meteorological data is useful for proper interpretation of the baseline data. It is used as input for air quality dispersion models for predicting the post project environmental scenario i.e. ground level concentrations due to mining activities, Quarry machineries, DG set & vehicles etc.

### 3.6.2 Meteorological Data Collection

Available secondary data pertaining to the meteorological parameters was obtained from the IMD Climatological tables. In addition, baseline meteorological data (primary data) was generated during the Pre-monsoon Season **(Mid of Jan 2023 – Mid of April 2023)**. The methodology adopted for monitoring surface observations is as per the standard norms laid down by Bureau of Indian Standards (BIS) i.e. IS:8829 and Indian Meteorological Department (IMD).

### 3.6.3 General Meteorological Scenario based on IMD Data

The nearest Indian Meteorological Department (IMD) station located to project site is Vellore. The Climatological data for Vellore (12°55' N and 79°09' E), published by the IMD, based on daily observations at 08:30 and 17:30 hour IST for a 30-year period, is presented in the following sections on the meteorological conditions of the region. The monthly variations of the relevant meteorological parameters are reproduced in **Table 3.5**.

**Table 3-5 Climatological Summary – Vellore (1991-2020)**

| Month | Temp ($^{o}$C) | | Rainfall (mm) | | Relative Humidity (%) | | Vapour Pressure hPa | | Mean Wind Speed (kmph) | Predominant Wind Directions (From)* | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Daily Max. | Daily Min. | Total | No. of days | 08:30 | 17:30 | 08:30 | 17:30 | | 08:30 | 17:30 |
| **Jan** | 29.9 | 18 | 6.8 | 0.6 | 88 | 56 | 22.1 | 21.4 | 3.1 | NE | NE |
| **Feb** | 32.8 | 19.1 | 5.5 | 0.4 | 84 | 49 | 23 | 21.9 | 3.6 | NE | NE |
| **Mar** | 36.2 | 21.8 | 11.4 | 0.6 | 80 | 43 | 25.8 | 22.7 | 3.3 | SW,W | E |
| **Apr** | 38.3 | 24.8 | 30.5 | 1.7 | 74 | 43 | 29.3 | 24.8 | 4 | SW | SE |
| **May** | 39.2 | 26 | 63.8 | 4.4 | 67 | 48 | 287 | 26.6 | 3.9 | SW | SW |
| **Jun** | 36.7 | 25.5 | 89.9 | 5 | 67 | 51 | 27.2 | 26.7 | 4.9 | SW | SW |
| **Jul** | 35.2 | 24.9 | 104.9 | 5.9 | 70 | 55 | 26.8 | 27.1 | 4.8 | SW | SW |
| **Aug** | 34.4 | 24.3 | 144.9 | 8 | 75 | 60 | 27.4 | 28.3 | 4.1 | W | SW |
| **Sep** | 33.9 | 23.8 | 183.8 | 8.7 | 78 | 65 | 28 | 28.9 | 3.2 | SW | SW |
| **Oct** | 32.3 | 22.8 | 167.4 | 9.2 | 83 | 71 | 28.1 | 28.3 | 2.2 | SW | NE |
| **Nov** | 29.9 | 20.9 | 165.4 | 7.9 | 87 | 73 | 26.1 | 26.3 | 2.2 | NE | NE |
| **Dec** | 28.8 | 18.6 | 75.8 | 3.6 | 88 | 67 | 23.2 | 23.3 | 2.6 | NE | NE |
| **Max.** | **39.2** | **26** | **183.8** | **9.2** | **88** | **73** | **287** | **28.9** | **4.9** | **Annual Wind Predominant direction is & NORTH EAST** | |
| **Min.** | **28.8** | **18** | **5.5** | **0.4** | **67** | **43** | **22.1** | **21.4** | **2.2** | | |
| **Avg. /Total.** | **33.9** | **22.5** | **1050.1** | **56.0** | **79** | **57** | **26.3** | **25.5** | **3.5** | | |

As per the above IMD Climatological **Table 3.5,** the observations drawn are the following.

- Daily maximum temperature is 39.2°C and the daily minimum temperature is 18°C were recorded in the months of May and January respectively.
- Maximum and minimum relative humidity of 88% and 43% were recorded in the months of January, December and March, April respectively.
- Maximum and minimum rainfall of 183.8 mm and 5.5 mm was recorded in the months of September and February respectively. Annual total rainfall recorded in the region was 1050.1 mm.
- Maximum and minimum mean wind is 4.9 kmph and 2.2 kmph was recorded in the months of June and October, November respectively. Annual Wind predominant pattern is from **North East.**

### 3.6.4 Meteorological data during Study Period

The meteorological data of study period was used for interpretation of baseline status and to simulate the meteorological conditions for prediction of impacts in modeling studies. Meteorology Data for the Study Period (Mid of Jan 2023 to Mid of April 2023) is presented in **Table 3.6.**

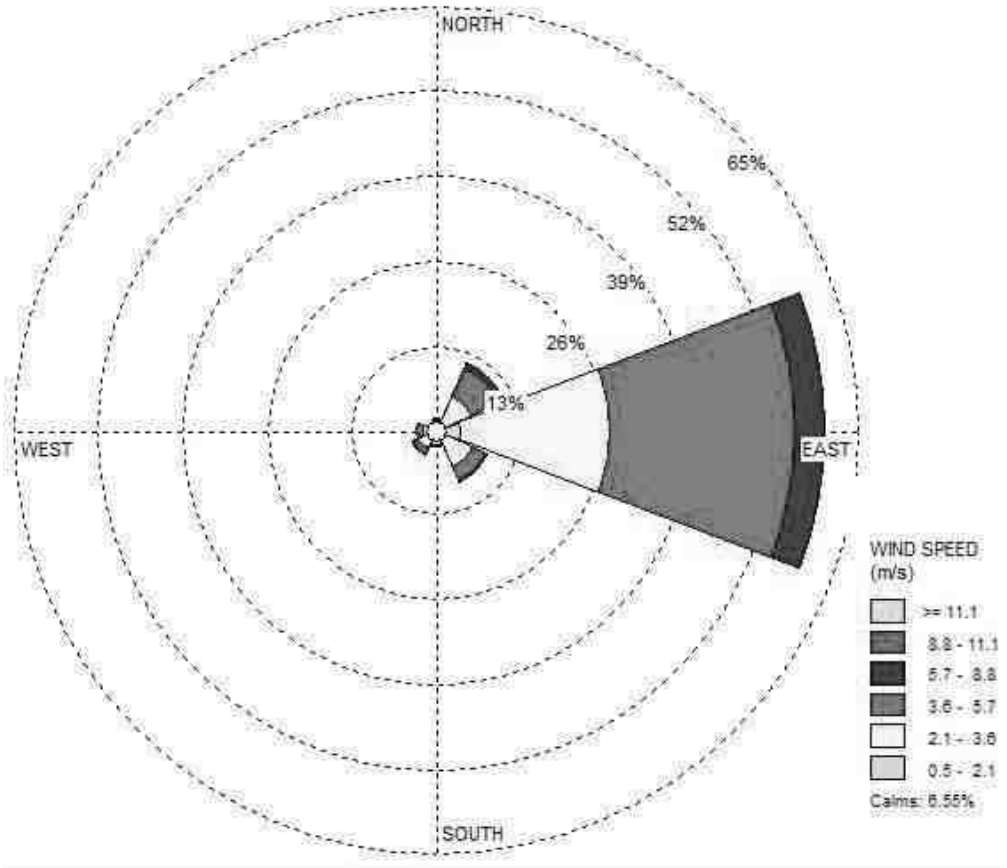



**Figure 3-17 Wind rose diagram considered for Dispersion Modelling (Mid of Jan 2023 to Mid of April 2023)**

**Table 3-6 Meteorology Data for the Study Period (December 2020 - February 2021)**

| S.No | Parameter | Observation |
|---|---|---|
| 1. | Temperature | Max Temperature: 34.0°C<br>Min Temperature: 14.0°C<br>Avg Temperature: 25.08°C |
| 2. | Average Relative Humidity | 52.51% |
| 3. | Average Wind Speed | 3.12 m/s |
| 4. | Predominant Wind Direction | East |

### 3.6.5 Atmospheric Inversion

Atmospheric inversion level at the project site was monitored; the results observed at the site during the study period are as follows

- Average atmospheric temperature: 25.08°C
- Average Relative humidity: 52.51 %
- Average Wind speed: 3.12 m/s

The daily inversion level calculated based on the average temperature and average wind speed at the project site and the maximum inversion height is derived by the graph plotted based on the average temperature and average wind speed. The daily inversion level at the project site varies from 50 to 2887m during 6 AM to 4 PM, the maximum recorded at 4 PM, March 2023. This is shown in the following **Figure 3.18**

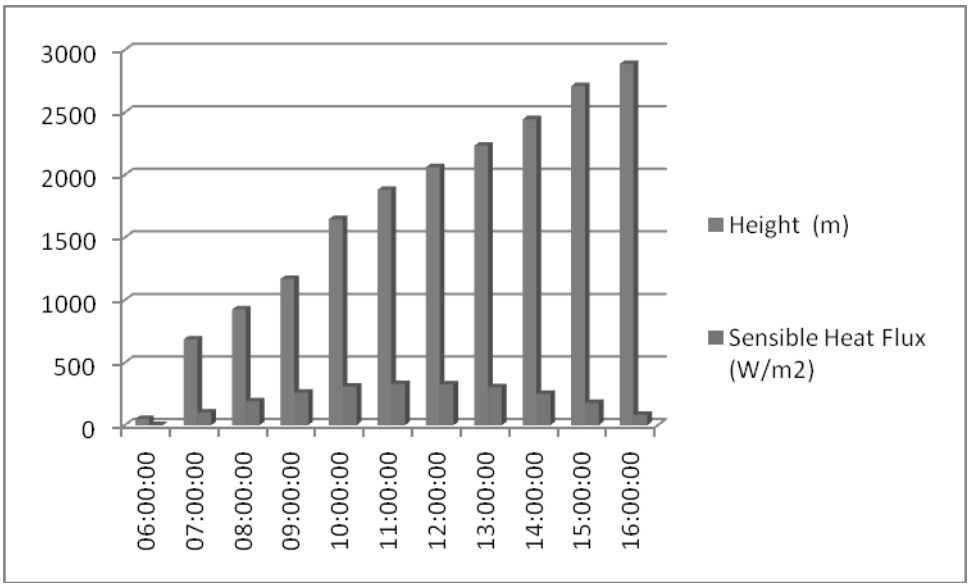



**Figure 3-18 Atmospheric inversion level at the project site**

## 3.7 Ambient Air Quality

The selection criteria for monitoring locations are based on the following:

- Topography/Terrain
- Meteorological conditions

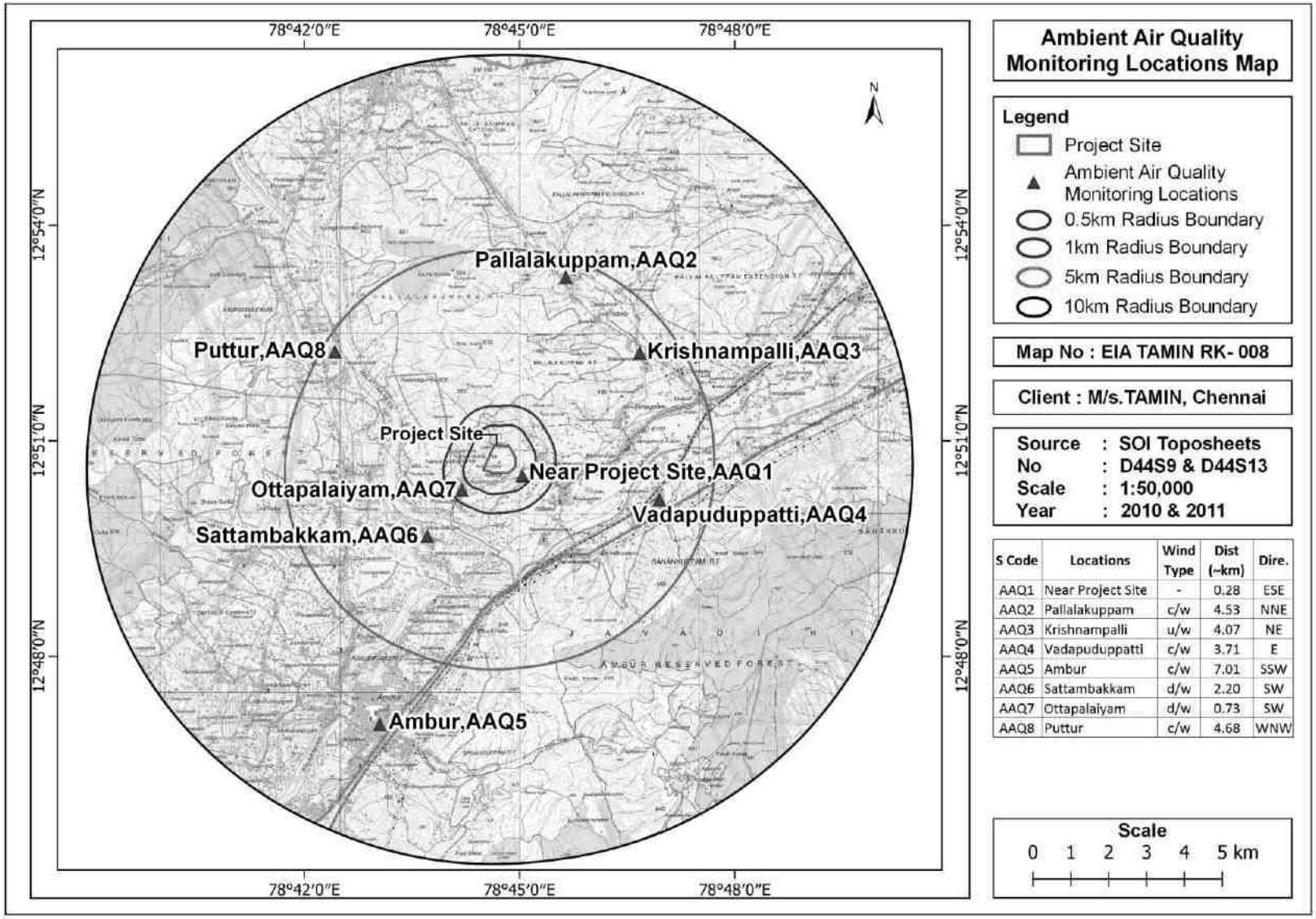
- Residential and sensitive areas within the study area
- Representatives of regional background air quality/pollution levels and
- Representation of likely impacted areas

### 3.7.1 Ambient Air Quality Monitoring Stations

To evaluate the baseline air quality of the study area, Eight (08) monitoring locations have been identified as per Study period wind predominance. The Study period wind predominance is North East. Map showing the AAQ monitoring locations is given in **Figure 3.19** and the details of the locations are given in **Table 3.7.**

**Table 3-7 Details of Ambient Air Quality Monitoring Locations**

| Station Code | Location | Type of Wind | Distance (~km) from Project boundary | Azimuth Directions |
|---|---|---|---|---|
| AAQ1 | Near Project Site | - | 0.28 | ESE |
| AAQ2 | Pallalakuppam | c/w | 4.53 | NNE |
| AAQ3 | Krishnampalli | u/w | 4.07 | NE |
| AAQ4 | Vadapuduppatti | c/w | 3.71 | E |
| AAQ5 | Ambur | c/w | 7.01 | SSW |
| AAQ6 | Sattambakkam | d/w | 2.20 | SW |
| AAQ7 | Ottapalaiyam | d/w | 0.73 | SW |
| AAQ8 | Puttur | c/w | 4.68 | WNW |




| S Code | Locations | Wind Type | Dist (~km) | Dire. |
|---|---|---|---|---|
| AAQ1 | Near Project Site | - | 0.28 | ESE |
| AAQ2 | Pallalakuppam | c/w | 4.53 | NNE |
| AAQ3 | Krishnampalli | u/w | 4.07 | NE |
| AAQ4 | Vadapuduppatti | c/w | 3.71 | E |
| AAQ5 | Ambur | c/w | 7.01 | SSW |
| AAQ6 | Sattambakkam | d/w | 2.20 | SW |
| AAQ7 | Ottapalaiyam | d/w | 0.73 | SW |
| AAQ8 | Puttur | c/w | 4.68 | WNW |

**Figure 3-19 Map showing the Ambient Air Quality monitoring locations**

### 3.7.2 Ambient Air Quality Monitoring Techniques and Frequency

Ambient air quality was monitored twice in a week for One (01) season (shall cover 12 weeks), i.e. during Pre-Monsoon season (**March 2023- May 2023**). $PM_{10}$, $PM_{2.5}$, $SO_2$, $NO_x$, Pb, $NH_3$, $O_3$, CO, $C_6H_6$, $C_{20}H_{12}$, As, Ni and Free Silica was monitored. Sampling was carried out as per Central Pollution Control Board (CPCB) monitoring guidelines at each location. Analytical methods used for analysis of parameters are given in **Table 3.8.**

**Table 3-8 Analytical Methods for Analysis of Ambient Air Quality Parameters (NAAQ)**

| S.No | Parameters | Analytical method | NAAQ standards: 2009 | | Sampling Time |
|---|---|---|---|---|---|
| 1. | Sulphur Dioxide ($SO_2$), µg/$m^3$ | IS:5182(Part-2):2001 (Reaff:2006) | 50 (Annual) | 80(24 Hours) | 24 Hours |
| 2. | Nitrogen Dioxide ($NO_2$), µg/$m^3$ | IS: 5182 (Part - 6): 2006 | 40 (Annual) | 80 (24 Hours) | 24 Hours |
| 3. | Particulate Matter ($PM_{2.5}$), µg/$m^3$ | IS: 5182 (Part - 23): 2006 | 40 (Annual) | 60 (24 hours) | 24 Hours |
| 4. | Particulate Matter ($PM_{10}$), µg/$m^3$ | IS:5182 (Part– 23): 2006 | 60 (Annual) | 100 (24 hours) | 24 Hours |
| 5. | CO mg/$m^3$ | IS:5182(Part–10):1999 (Reaff:2006) | 2 (8 hours) | 4 (1hour) | 8 Hours |
| 6. | Pbµg/$m^3$ | IS:5182(Part–22):2004 (Reaff:2006) | 0.5(Annual) | 1(24 hours) | 24 Hours |
| 7. | $O_3$, µg/$m^3$ | IS: 5182 (Part – 9): 1974 | 100(8hours) | 180 (1hour) | 8 Hours |
| 8. | $NH_3$, µg/$m^3$ | APHA (air) 2nd edition (Indophenol-blue method) | 100(Annual) | 400(24 hours) | 8 Hours |
| 9. | Benzene, µg/$m^3$ | IS:5182(Part–11):1999 (RA:2009) | 5 (Annual) | 5 (Annual) | 24 Hours |
| 10. | Benzo (a) pyrene, ng/$m^3$ | IS:5182(Part–12):2004 (RA:2009) | 1 (Annual) | 1 (Annual) | 24 Hours |
| 11. | Arsenic, ng/ $m^3$ | APHA (air) 2nd edition | 6 (Annual) | 6 (Annual) | 24 Hours |
| 12. | Nickel ng/ $m^3$ | In house method (AAS method) based on CPCB guidelines volume 1 | 20(Annual) | 20(Annual) | 24 Hours |
| 13. | Free Silica | NIOSH Manual- Method 7601 | -- | -- | 8 hours |

**Results and Discussions**

The variations of the pollutants $PM_{10}$, $PM_{2.5}$, $SO_2$, $NO_2$, CO, Pb, $O_3$, $NH_3$, $C_6H_6$, $C_{20}$ $H_{12}$, As and Ni are compared with National Ambient Air Quality Standards (NAAQS), MoEF&CC Notification, November, 2009. Ambient Air Quality Monitoring Data (**March 2023 - May 2023**) for the study area is given in **Table 3.9** and trends of measured ambient concentration in the study area were graphically represented in **Figure 3-20.**

**Table 3-9 Summary of the average baseline concentrations of pollutants**

| Parameters | Conc. | NAAQ Standards | Locations | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Near Project Site | Pallalakuppam | Krishnampalli | Vadapuduppatti | Ambur | Sattambakkam | Ottapalaiyam | Puttur |
| | | | AAQ1 | AAQ2 | AAQ3 | AAQ4 | AAQ5 | AAQ6 | AAQ7 | AAQ8 |
| $PM_{10}$ Conc. ($\mu g/m^3$) | Min. | 100 (24 Hours) | 38.68 | 26.59 | 30.49 | 34.41 | 37.56 | 40.61 | 35.97 | 35.62 |
| | Max. | | 55.12 | 37.90 | 43.46 | 49.04 | 53.53 | 57.88 | 51.27 | 50.77 |
| | Avg. | | **46.38** | **31.90** | **36.57** | **41.27** | **45.04** | **48.71** | **43.14** | **42.72** |
| | $98^{th}$ 'tile | | 54.80 | 37.68 | 43.21 | 48.76 | 53.22 | 57.55 | 50.97 | 50.47 |
| $PM_{2.5}$ Conc. ($\mu g/m^3$) | Min. | 60 (24 Hours) | 25.20 | 18.99 | 19.82 | 22.37 | 24.42 | 26.40 | 23.49 | 23.15 |
| | Max. | | 35.91 | 27.06 | 28.25 | 31.88 | 34.80 | 37.63 | 33.47 | 33.00 |
| | Avg. | | **30.22** | **22.77** | **23.78** | **26.83** | **29.28** | **31.66** | **28.17** | **27.77** |
| | $98^{th}$ 'tile | | 35.71 | 26.90 | 28.09 | 31.70 | 34.59 | 37.41 | 33.28 | 32.81 |
| $SO_2$ Conc. ($\mu g/m^3$) | Min. | 80 (24 Hours) | 10.54 | 9.06 | 7.82 | 10.55 | 9.42 | 12.20 | 11.26 | 10.50 |
| | Max. | | 15.02 | 12.91 | 11.14 | 15.04 | 13.42 | 17.39 | 16.05 | 14.96 |
| | Avg. | | **12.64** | **10.87** | **9.38** | **12.66** | **11.30** | **14.63** | **13.51** | **12.59** |
| | $98^{th}$ 'tile | | 14.93 | 12.84 | 11.07 | 14.95 | 13.35 | 17.29 | 15.96 | 14.87 |
| $NO_2$Conc. ($\mu g/m^3$) | Min. | 80 (24 Hours) | 21.11 | 18.47 | 16.15 | 21.41 | 19.11 | 24.39 | 22.05 | 18.61 |
| | Max. | | 30.08 | 26.32 | 23.01 | 30.51 | 27.24 | 34.76 | 31.43 | 26.53 |
| | Avg., | | **25.32** | **22.15** | **19.37** | **25.68** | **22.92** | **29.25** | **26.45** | **22.32** |
| | $98^{th}$ 'tile | | 29.91 | 26.17 | 22.88 | 30.33 | 27.08 | 34.56 | 31.25 | 26.37 |
| Pb ($\mu g/m^3$) | Avg. | 1 (24 hour) | BLQ (LOQ 0.05) | BLQ (LOQ 0.05) | BLQ (LOQ 0.05) | BLQ (LOQ 0.05) | BLQ (LOQ 0.05) | BLQ (LOQ 0.05) | BLQ (LOQ 0.05) | BLQ (LOQ 0.05) |
| CO ($mg/m^3$) | Avg. | 4 (1hour) | 0.55 | 0.24 | 0.2 | 0.58 | 0.25 | 0.62 | 0.3 | 0.4 |
| $O_3$ ($\mu g/m^3$) | Avg. | 180(1hour) | BLQ(LOQ 10) | BLQ(LOQ 10) | BLQ(LOQ 10) | BLQ(LOQ 10) | BLQ(LOQ 10) | BLQ(LOQ 10) | BLQ(LOQ 10) | BLQ(LOQ 10) |
| Benzene $C_6H_6$ ($\mu g/m^3$) | Avg. | 5 (Annual) | BLQ (LOQ 1) | BLQ (LOQ 1) | BLQ (LOQ 1) | BLQ (LOQ 1) | BLQ (LOQ 1) | BLQ (LOQ 1) | BLQ (LOQ 1) | BLQ (LOQ 1) |
| Benzo(a) Pyrene $C_{20}H_{12}$ (a), ($ng/m^3$) | Avg. | 1 (Annual) | BLQ (LOQ 1) | BLQ (LOQ 1) | BLQ (LOQ 1) | BLQ (LOQ 1) | BLQ (LOQ 1) | BLQ (LOQ 1) | BLQ (LOQ 1) | BLQ (LOQ 1) |

| Parameters | Conc. | NAAQ Standards | Locations | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Near Project Site | Pallalakuppam | Krishnampalli | Vadapudupatti | Ambur | Sattambakkam | Ottapalaiyam | Puttur |
| | | | AAQ1 | AAQ2 | AAQ3 | AAQ4 | AAQ5 | AAQ6 | AAQ7 | AAQ8 |
| **As (ng/ $m^3$)** | **Avg.** | **6 (Annual)** | BLQ (LOQ 2) | BLQ (LOQ 2) | BLQ (LOQ 2) | BLQ (LOQ 2) | BLQ (LOQ 2) | BLQ (LOQ 2) | BLQ (LOQ 2) | BLQ (LOQ 2) |
| **Ni (ng/$m^3$)** | **Avg.** | **20 (Annual)** | BLQ (LOQ 10) | BLQ(LOQ 10) | BLQ(LOQ 10) | BLQ(LOQ 10) | BLQ(LOQ 10) | BLQ(LOQ 10) | BLQ(LOQ 10) | BLQ(LOQ 10) |
| **$NH_3$(µg/$m^3$)** | **Avg.** | **400 (24 hour)** | BLQ(LOQ 5) | BLQ(LOQ 5) | BLQ(LOQ 5) | BLQ(LOQ 5) | BLQ(LOQ 5) | BLQ(LOQ 5) | BLQ(LOQ 5) | BLQ(LOQ 5) |
| **Free Silica** | **Avg.** | **--** | BLQ (LOQ 0.04) | BLQ (LOQ 0.04) | BLQ (LOQ 0.04) | BLQ (LOQ 0.04) | BLQ (LOQ 0.04) | BLQ (LOQ 0.04) | BLQ (LOQ 0.04) | BLQ (LOQ 0.04) |

***Note:*** *BLQ (Below the Limit of Quantifications), LOQ (Limit of Quantifications)*

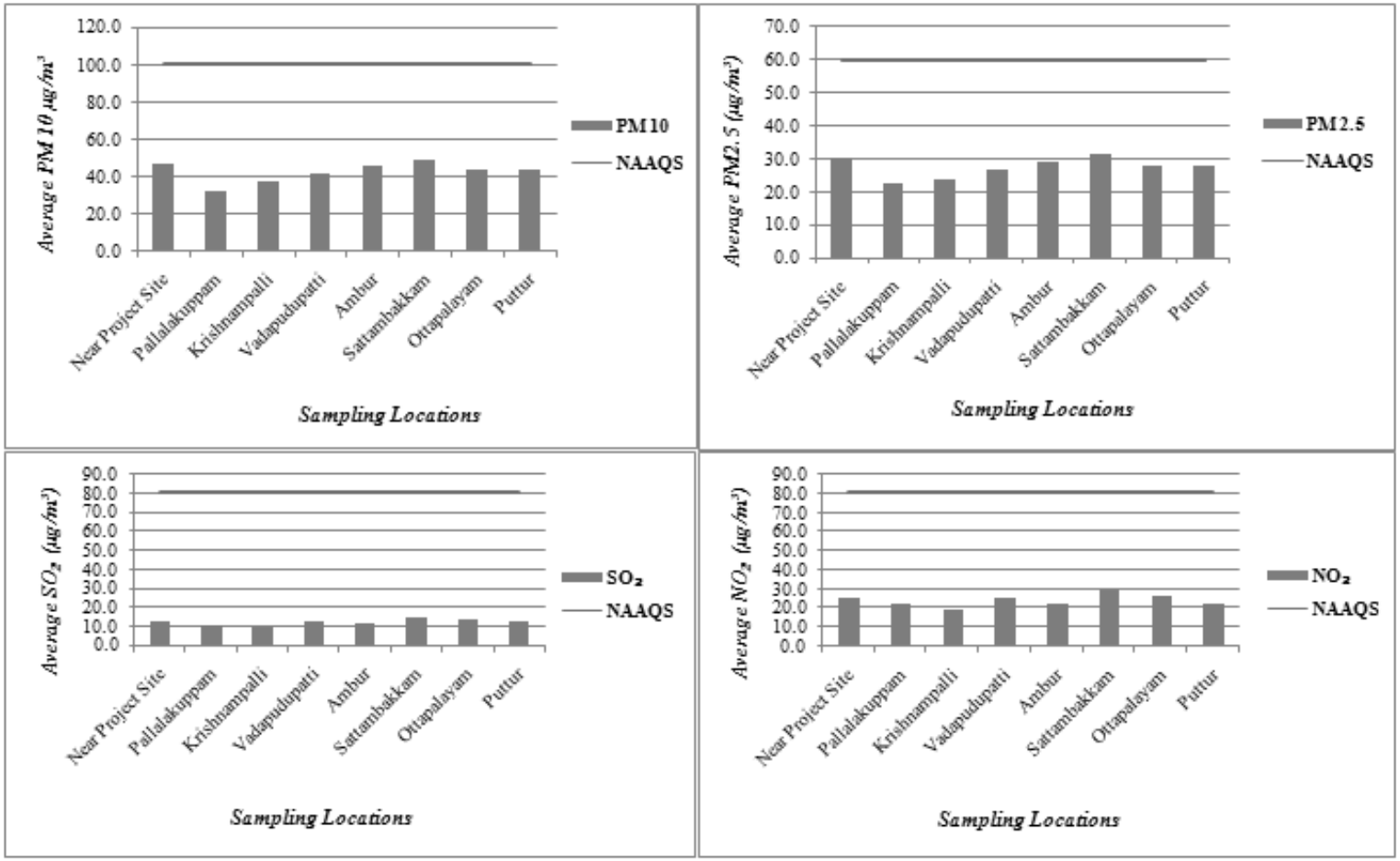



**Figure 3-20 Trends of Measured Ambient Concentrations in the Study Area**

**Observations**

The ambient air quality has been monitored at 8 locations for 12 parameters as per NAAQS, 2009 within the study area. The average baseline levels of $PM_{10}$ (31.9 µg/m³- 48.71 µg/m³), $PM_{2.5}$(22.77µg/m³ -31.66 µg/m³), $SO_2$ (9.38µg/m³ – 14.63 µg/m³), $NO_2$(19.37µg/m³ – 29.25µg/m³), CO (0.2 mg/$m^3$– 0.62 mg/$m^3$), all the parameters are well within the National Ambient Air Quality Standards for Industrial, Commercial and Residential areas at all monitoring locations during the study period.

## 3.8 Noise Environment

The prevailing ambient noise level at a particular location is nothing but the resultant (total) of all kinds of noise sources existing at various distances around that location. The ambient noise level at a location varies continuously depending on the type of surrounding activities.

Ambient noise levels have been established by monitoring noise levels at Eight (08) locations in and around 10 km distance from project area during the study period using precision noise level meter. The noise monitoring locations in the study area were selected after giving due consideration to the various land use categories. The land use categories include commercial, residential, rural and sensitive areas. Noise levels were recorded on an hourly basis for one complete day at each location using pre- calibrated noise levels. Sampling images and map noise showing the noise monitoring locations are given in **Figure 3.21.**

### 3.8.1 Results and Discussions:

Based on the recorded hourly noise levels at each monitoring location, the day equivalent (Ld) and night equivalent (Ln) were calculated;

Ld: Average noise levels between 6:00 hours to 22.00 hours.

Ln: Average noise levels between 22:00 hours to 6.00 hours.

The comparison of day equivalent noise levels (Ld) and night equivalent noise levels (Ln) with the respective CPCB stipulated noise standards for various land use categories are shown in the **Table 3.11.**

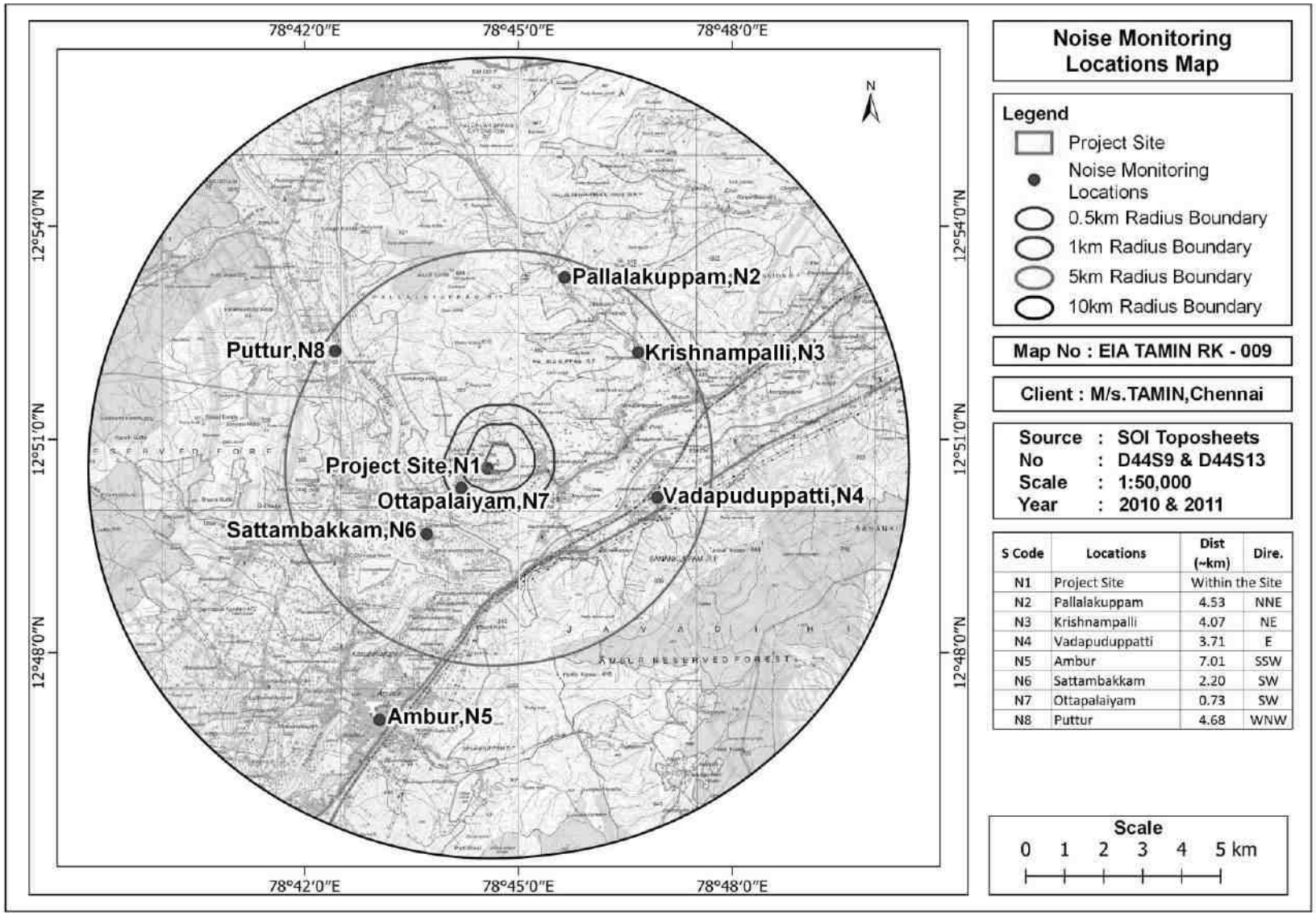
**Table 3-10 Day and Night Equivalent Noise Levels**

| Location Code | Location | Distance (~km) from Project boundary | Azimuth Direction | Noise level in dB(A) Leq | | CPCB Standard | | Environmental Setting |
|---|---|---|---|---|---|---|---|---|
| | | | | Day | Night | Lday (Ld) | LNight (Ln) | |
| N1 | Project Site | Within the Site | | 59.2 | 61.8 | 75 | 70 | Industrial |
| N2 | Pallalakuppam | 4.53 | NNE | 53.6 | 42.9 | 55 | 45 | Residential |
| N3 | Krishnampalli | 4.07 | NE | 54.2 | 41.5 | 55 | 45 | Residential |
| N4 | Vadapuduppatti | 3.71 | E | 52.7 | 42.9 | 55 | 45 | Residential |
| N5 | Ambur | 7.01 | SSW | 52.1 | 42.2 | 55 | 45 | Residential |
| N6 | Sattambakkam | 2.20 | SW | 53.4 | 40.9 | 55 | 45 | Residential |
| N7 | Ottapalaiyam | 0.73 | SW | 51.9 | 44.2 | 55 | 45 | Residential |
| N8 | Puttur | 4.68 | WNW | 54.1 | 43.8 | 55 | 45 | Residential |

### 3.8.2 Observations

It is observed that the day equivalent and night equivalent noise levels at all locations are within prescribed CPCB standards.

- In industrial area, day time noise level was about 59.2 dB(A) and 61.8 dB(A) during night time, which is within prescribed limit by MoEF&CC (75 dB(A) Day time & 70 dB(A) Night time).
- In residential area day time noise levels varied from 51.9 dB(A) to 54.2 dB(A) and night time noise levels varied from 40.9 dB(A) to 44.2dB(A) across the sampling stations. The field observations during the study period indicates that the ambient noise levels are within the prescribed limit noise by CPCB (55 dB(A) Day time & 45 dB(A) Night time).




| S Code | Locations | Dist (~km) | Dire. |
|---|---|---|---|
| N1 | Project Site | Within the Site | |
| N2 | Pallalakuppam | 4.53 | NNE |
| N3 | Krishnampalli | 4.07 | NE |
| N4 | Vadapuduppatti | 3.71 | E |
| N5 | Ambur | 7.01 | SSW |
| N6 | Sattambakkam | 2.20 | SW |
| N7 | Ottapalaiyam | 0.73 | SW |
| N8 | Puttur | 4.68 | WNW |

**Figure 3-21 Map showing the noise monitoring location**

## 3.9 Water Environment

### 3.9.1 Surface Water Resources

Rivers such as Palar, Ponnai, Pamban, Malattar, Kavundinyanadi, Agaram Aru, Kallar, Naganadi and Goddar are imporatnt but not useful irrigation as they mostly dry and sand wastes except heavy rain seasons. Other rivers such as Goddar and Kavundinyanadi originating from north to south in Gudiyatham flows in to Palar River.

***Source:***

https://censusindia.gov.in/2011census/dchb/DCHB_A/33/3304_PART_A_DCHB_VELLORE.pdf

*(**Ref:** Directorate of Census Operations Tamil Nadu, "District Census Handbook 2011, Vellore District", Series-34, Part XII-A)*

***Note:** Ranipet district was a part of Vellore district before the bifurcation on 28th November 2019. Since secondary sources are available only for Vellore district, however Vellore district comprises Ranipet district details before bifurcation.*

### 3.9.2 Surface Water Quality Assessment

Water quality monitoring and assessment can be used to determine ambient water quality, the extent and causes of a water quality problem, or to measure the effectiveness of best management practices will be implemented in water system. Monitoring helps to determine the trends in the quality of the aquatic environment and the impact due to the release of contaminants, other anthropogenic activities, and/or by waste treatment operations (impact monitoring).To establish the baseline status of water environment, the representative sampling locations for surface water within a radial distance of 10 Km from project site have been selected as per CPCB guidelines of Water Quality Monitoring through an adequate survey of the project area. Test methods used for the analysis of water quality parameters is given in**Table 3.11**.Water sampling and map of sampling location are given in **Table 3.12** and **Figure 3.22.**

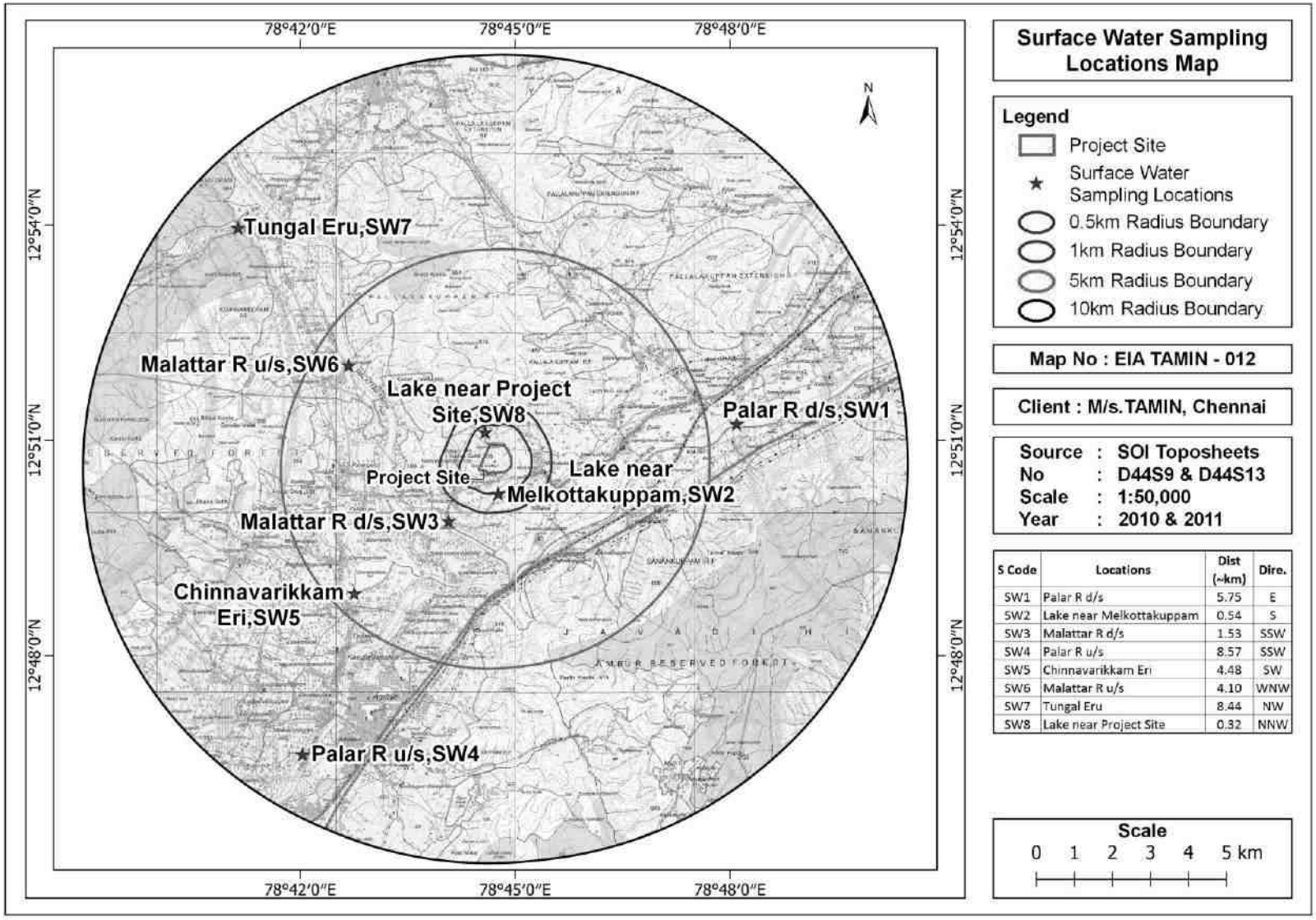
**Table 3-11 Test methods used for the analysis of water quality parameters**

| S. No | Parameter Measured | Test Method |
|---|---|---|
| 1. | Colour | IS:3025 (Part- 4) 1983 |
| 2. | Turbidity | IS 3025(Part - 10):1984 |
| 3. | pH | IS:3025 (Part - 11): 1983 |
| 4. | Conductivity | IS:3025 (Part - 14): 1983 |
| 5. | Total Dissolve Solids | IS:3025:1(Part - 16) 1984 |
| 6. | Total Suspended Solids | IS 3025 (Part - 17) 1984 |
| 7. | Alkalinity as CaCO3 | IS:3025,1 (Part - 23) 1986 |
| 8. | Total Hardness as CaCo3 | IS:3025 (Part - 21) 1983 |
| 9. | Sodium | IS:3025,5(Part - 45) 1993 |
| 10. | Potassium | IS:3025,5(Part - 45) 1993 |
| 11. | Calcium as Ca | IS 3025 (Part - 40):1991 |
| 12. | Magnesium as Mg | IS 3025 (Part - 46) 1994 |
| 13. | Chloride | IS 3025 (Part - 32):1988 |

| S. No | Parameter Measured | Test Method |
|---|---|---|
| 14. | Sulphate SO4 | IS 3025(Part - 24):1986 |
| 15. | Nitrate as NO3 | ASTM(Part - 31)1978 |
| 16. | Phosphate | IS 3025 (Pt 45) 1993 |
| 17. | Fluorides as F | IS 3025 (Part - 60):2008 |
| 18. | Cyanide | IS 3025 (Part-27):1986 |
| 19. | Arsenic | IS 3025:(Part-37):1988 |
| 20. | Boron | IS:3025 (Part - 57):2003 |
| 21. | Cadmium | IS 3025 (Part - 41)1991 |
| 22. | Chromium, Total | IS:3025 (Part - 52) 2003 |
| 23. | Copper | IS:3025 (Part - 42)1992 |
| 24. | Iron | IS 3025 (Part - 53):2003 |
| 25. | Lead | IS:3025 (Part - 47) 1994 |
| 26. | Manganese | IS 3025:(Part - 59):2006 |
| 27. | Mercury | IS 3025 (Part48):1994 RA 1999 |
| 28. | Nickel | IS 3025:(Part-54):2003 |
| 29. | Selenium | IS 3025 Part (56)2003 |
| 30. | Zinc | IS:3025 (Part - 49) 1994 |
| 31. | Dissolved Oxygen | IS:3025 (Part - 38)1989 |
| 32. | BOD | 5210B APHA22nd Edn 2012 |
| 33. | COD | IS:3025 (Part-58)-2006 |
| 34. | Total Coliform | IS 1622: 1981 |

**Table 3-12 Details of Surface water sampling locations**

| Location Code | Locations | Distance from Project Boundary(~km) | Direction from project boundary |
|---|---|---|---|
| SW1 | Palar R d/s | 5.75 | E |
| SW2 | Lake near Melkottakuppam | 0.54 | S |
| SW3 | Malattar R d/s | 1.53 | SSW |
| SW4 | Palar R u/s | 8.57 | SSW |
| SW5 | Chinnavarikkam Eri | 4.48 | SW |
| SW6 | Malattar R u/s | 4.10 | WNW |
| SW7 | Tungal Eru | 8.44 | NW |
| SW8 | Lake near Project Site | 0.32 | NNW |




| S Code | Locations | Dist (~km) | Dire. |
|---|---|---|---|
| SW1 | Palar R d/s | 5.75 | E |
| SW2 | Lake near Melkottakuppam | 0.54 | S |
| SW3 | Malattar R d/s | 1.53 | SSW |
| SW4 | Palar R u/s | 8.57 | SSW |
| SW5 | Chinnavarikkam Eri | 4.48 | SW |
| SW6 | Malattar R u/s | 4.10 | WNW |
| SW7 | Tungal Eru | 8.44 | NW |
| SW8 | Lake near Project Site | 0.32 | NNW |

**Figure 3-22 Map showing the surface water monitoring locations**

**Table 3-13 Physicochemical Parameters of Surface water samples from study area**

| S. No | Parameter | Unit | Surface water standards (IS 2296 Class-A) | Palar R d/s | Lake near Melkotta kuppam | Malattar R d/s | Palar R u/s | Chinnavarikkam Eri | Malattar R u/s | Tungal Eru | Lake near Project Site |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | SW1 | SW2 | SW3 | SW4 | SW5 | SW6 | SW7 | SW8 |
| 1. | **pH (at 25°C)** | **--** | **6.5-8.5** | 6.9 | 7.1 | 6.8 | 7.2 | 7.33 | 6.98 | 7.56 | 6.77 |
| 2. | **Electrical Conductivity** | **µS/cm** | **-** | 541.89 | 724.45 | 536.12 | 619.74 | 653.16 | 749.81 | 761.27 | 608.49 |
| 3. | **Total Dissolved Solids** | **mg/l** | **500** | 221.89 | 357.14 | 259.48 | 334.65 | 303.21 | 459.93 | 509.64 | 367.58 |
| 4. | **Total Suspended Solids** | **mg/l** | **-** | 16 | 42 | 36 | 19 | 51 | 16 | 17.6 | 23.9 |
| 5. | **Total Alkalinity as $CaCO_3$** | **mg/l** | **-** | 335.7 | 249.3 | 200.8 | 179.64 | 234.67 | 201.34 | 193.27 | 146.21 |
| 6. | **Total Hardness as $CaCO_3$** | **mg/l** | **200** | 324.6 | 194.61 | 146.28 | 133.69 | 201.57 | 211.78 | 187.64 | 249.67 |
| 7. | **Sodium as Na** | **mg/l** | **-** | 16.7 | 54.8 | 77.5 | 24.6 | 56.7 | 83.4 | 47.6 | 113.7 |
| 8. | **Potassium as K** | **mg/l** | **-** | 29.7 | 24.8 | 15.7 | 27.6 | 5.8 | 9.1 | 6.7 | 8.87 |
| 9. | **Calcium as Ca** | **mg/l** | **-** | 87 | 94.78 | 66.57 | 32.43 | 41.22 | 56.27 | 63.19 | 98.26 |
| 10. | **Magnesium as Mg** | **mg/l** | **-** | 36.24 | 26.29 | 41.87 | 26.77 | 41.27 | 37.48 | 31.77 | 51.24 |
| 11. | **Chloride as Cl** | **mg/l** | **250** | 187.64 | 142.67 | 132.24 | 99.63 | 78.94 | 89.27 | 111.27 | 131.28 |
| 12. | **Sulphate as $SO_4$** | **mg/l** | **400** | 53.7 | 29.4 | 36.7 | 15.8 | 24.9 | 26.7 | 22.6 | 21.9 |
| 13. | **Nitrate as $NO_3$** | **mg/l** | **20** | 11.2 | 9.7 | 8.4 | 16.3 | 15.7 | 12.8 | 19.4 | 15.5 |
| 14. | **Fluorides as F** | **mg/l** | **1.5** | 0.94 | 1.11 | 0.87 | 0.46 | 1.22 | 0.76 | 0.98 | 1.24 |
| 15. | **Cyanide** | **mg/l** | **0.05** | BLQ(LOQ 0.01) | BLQ(LOQ 0.01) | BLQ(LOQ 0.01) | BLQ(LOQ 0.01) | BLQ(LOQ 0.01) | BLQ(LOQ 0.01) | BLQ(LOQ 0.01) | BLQ(LOQ 0.01) |
| 16. | **Arsenic** | **mg/l** | **0.05** | BLQ(LOQ 0.005) | BLQ(LOQ 0.005) | BLQ(LOQ 0.005) | BLQ(LOQ 0.005) | BLQ(LOQ 0.005) | BLQ(LOQ 0.005) | BLQ(LOQ 0.005) | BLQ(LOQ 0.005) |
| 17. | **Cadmium as Cd** | **mg/l** | **0.01** | BLQ(LOQ 0.001) | BLQ(LOQ 0.001) | BLQ(LOQ 0.001) | BLQ(LOQ 0.001) | BLQ(LOQ 0.001) | BLQ(LOQ 0.001) | BLQ(LOQ 0.001) | BLQ(LOQ 0.001) |
| 18. | **Chromium, Total** | **mg/l** | **0.05** | BLQ(LOQ 0.01) | BLQ(LOQ 0.01) | BLQ(LOQ 0.01) | BLQ(LOQ 0.01) | BLQ(LOQ 0.01) | BLQ(LOQ 0.01) | BLQ(LOQ 0.01) | BLQ(LOQ 0.01) |
| 19. | **Copper as Cu** | **mg/l** | **1.5** | BLQ(LOQ 0.01) | BLQ(LOQ 0.01) | BLQ(LOQ 0.01) | BLQ(LOQ 0.01) | BLQ(LOQ 0.01) | BLQ(LOQ 0.01) | BLQ(LOQ 0.01) | BLQ(LOQ 0.01) |

| S. No | Parameter | Unit | Surface water standards (IS 2296 Class-A) | Palar R d/s | Lake near Melkotta kuppam | Malattar R d/s | Palar R u/s | Chinnavarikkam Eri | Malattar R u/s | Tungal Eru | Lake near Project Site |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | SW1 | SW2 | SW3 | SW4 | SW5 | SW6 | SW7 | SW8 |
| 20. | **Lead as Pb** | **mg/l** | **0.1** | BLQ(LOQ 0.005) | BLQ(LOQ 0.005) | BLQ(LOQ 0.005) | BLQ(LOQ 0.005) | BLQ(LOQ 0.005) | BLQ(LOQ 0.005) | BLQ(LOQ 0.005) | BLQ(LOQ 0.005) |
| 21. | **Manganese as Mn** | **mg/l** | **0.5** | BLQ(LOQ 0.05) | BLQ(LOQ 0.05) | BLQ(LOQ 0.05) | BLQ(LOQ 0.05) | BLQ(LOQ 0.05) | BLQ(LOQ 0.05) | BLQ(LOQ 0.05) | BLQ(LOQ 0.05) |
| 22. | **Mercury** | **mg/l** | **0.001** | BLQ(LOQ 0.0005) | BLQ(LOQ 0.0005) | BLQ(LOQ 0.0005) | BLQ(LOQ 0.0005) | BLQ(LOQ 0.0005) | BLQ(LOQ 0.0005) | BLQ(LOQ 0.0005) | BLQ(LOQ 0.0005) |
| 23. | **Nickel as Ni** | **mg/l** | **-** | BLQ(LOQ 0.01) | BLQ(LOQ 0.01) | BLQ(LOQ 0.01) | BLQ(LOQ 0.01) | BLQ(LOQ 0.01) | BLQ(LOQ 0.01) | BLQ(LOQ 0.01) | BLQ(LOQ 0.01) |
| 24. | **Selenium as Se** | **mg/l** | **0.01** | BLQ(LOQ 0.005) | BLQ(LOQ 0.005) | BLQ(LOQ 0.005) | BLQ(LOQ 0.005) | BLQ(LOQ 0.005) | BLQ(LOQ 0.005) | BLQ(LOQ 0.005) | BLQ(LOQ 0.005) |
| 25. | **Zinc as Zn** | **mg/l** | **15** | BLQ(LOQ 0.1) | BLQ(LOQ 0.1) | BLQ(LOQ 0.1) | BLQ(LOQ 0.1) | BLQ(LOQ 0.1) | BLQ(LOQ 0.1) | BLQ(LOQ 0.1) | BLQ(LOQ 0.1) |
| 26. | **Dissolved Oxygen** | **mg/l** | **6** | 8.1 | 7.7 | 6.3 | 8.4 | 6.1 | 6.6 | 6.2 | 7.1 |
| 27. | **Chemical Oxygen Demand as $O_2$** | **mg/l** | **-** | 51 | 34.7 | 27.9 | 14.7 | 21.9 | 42.8 | 23.4 | 45.9 |
| 28. | **BOD, 3 days @ 27°C as $O_2$** | **mg/l** | **2** | 19.3 | 12.41 | 10.37 | 6.41 | 8.57 | 14.67 | 9.09 | 15.93 |
| 29. | **Total Coliform** | **MPN/ 100mL** | **50** | 15 | 33 | 29 | 17 | 37 | 51 | 19 | 22 |

***Note:*** *BLQ (Below the Limit of Quantification), LOQ (Limit of Quantification),*

**Results and Discussions**

Water sampling results are compared with Surface water standards IS 2296:1992.

- pH in the collected surface water samples varies between 6.77 to 7.56.
- The Total Dissolved Solids range from 221.89 mg/l to 509.64 mg/l.
- The Total hardness ranges between 133.69 mg/l – 324.6 mg/l.
- BOD values varying from 6.41 to 19.3 mg/l. COD varies from 14.7 to 45.9 mg/l.
- The concentration of heavy metals like As, Cd, Cr, Pb, Mn, Hg, Ni and Se are within the limits of IS 2296:1992.

### 3.9.3 Groundwater resources

Ground water occurs under phreatic conditions in the weathered zone and under semiconfined conditions in the fractures. The thickness of weathered zone varies from less than a metre to about 15 m in the area depending on the topography. Potential aquifer zones are also developed in these rocks by fractures persisting to depths, particularly along lineaments and their inter sections. The depth of dug wells in crystalline formations varies form 8 – 19.5 m bgl. Fracture zones have been encountered in the well down to a depth of 116 m bgl in the borehole drilled by CGWB. The thickness of alluvium along the course of Palar River ranges from 8 – 12 m.

***Source:***http://cgwb.gov.in/District_Profile/TamilNadu/Vellore.pdf
*(**Ref:** District Groundwater Brochure-Vellore District-Central Ground Water Board-January 2009)*

***Note:****Ranipet district was a part of Vellore district before the bifurcation on 28th November 2019. Since secondary sources are available only for Vellore district, however Vellore district comprises Ranipet district details before bifurcation.*

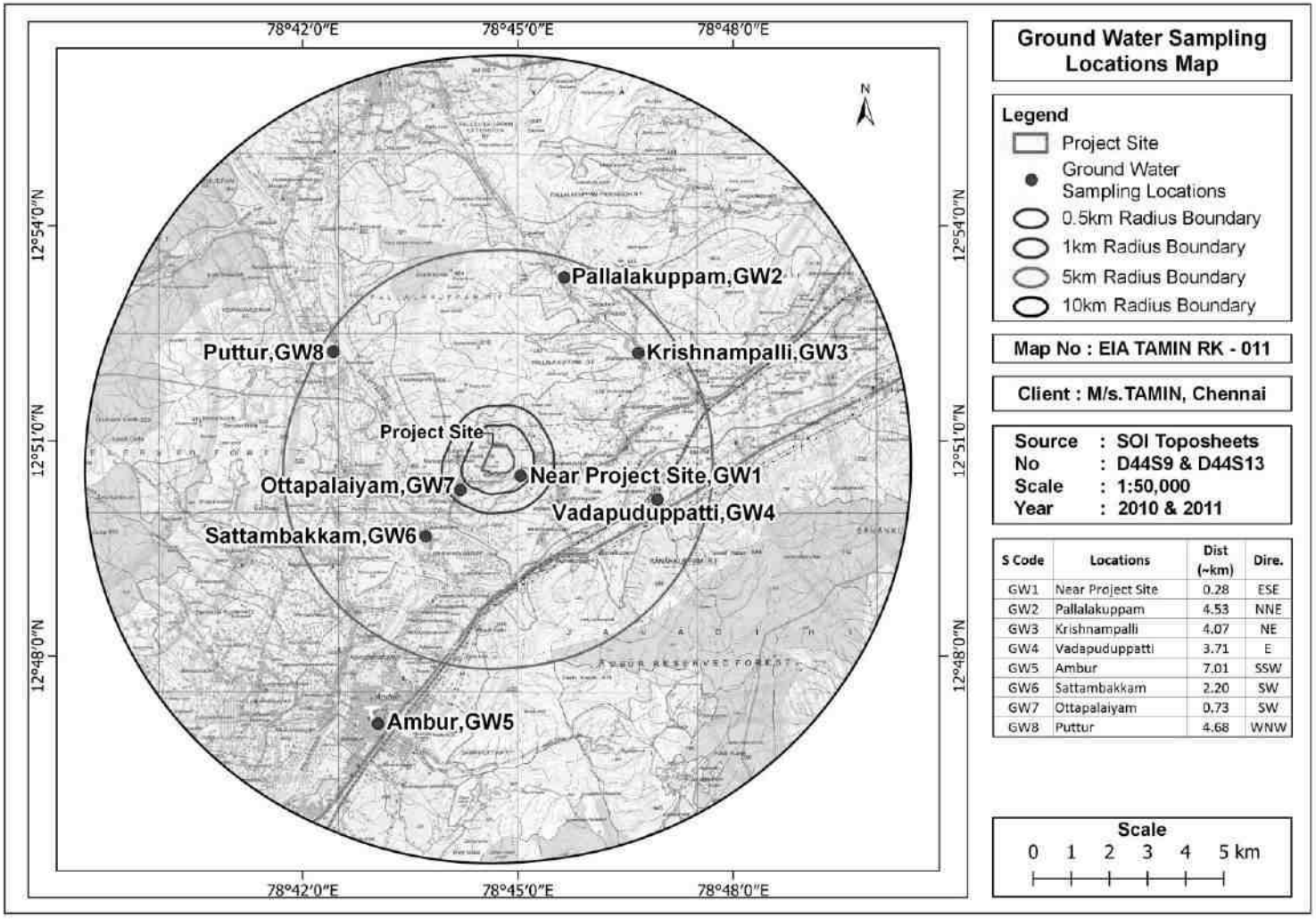
### 3.9.4 Groundwater Quality

Groundwater is the principal source for domestic and drinking purposes in almost all villages near the study area. The quality of the groundwater received is influenced by pollution of soil and air, industrial and domestic waste disposal, application of fertilizers and pesticides in agriculture, etc. Total Eight (08) ground water monitoring locations were identified for assessment in different villages around the project site based on the usage of sub surface water by the settlements/ villages in the study area. The groundwater results are compared with the acceptable and permissible limit of water quality standards as per IS: 10500 (2012) for drinking water. Groundwater quality monitoring locations and results are given in **Table 3.14** and **Table 3.15** and Map showing the groundwater monitoring locations is given in**Figure 3.23.**

**Table 3-14 Details of Groundwater Quality Monitoring Locations**

| Station Code | Location | Distance (km) from Project boundary | Azimuth Directions |
|---|---|---|---|
| **GW1** | Near Project Site | 0.28 | ESE |
| **GW2** | Pallalakuppam | 4.53 | NNE |
| **GW3** | Krishnampalli | 4.07 | NE |

| Station Code | Location | Distance (km) from Project boundary | Azimuth Directions |
|---|---|---|---|
| **GW4** | Vadapuduppatti | 3.71 | E |
| **GW5** | Ambur | 7.01 | SSW |
| **GW6** | Sattambakkam | 2.20 | SW |
| **GW7** | Ottapalaiyam | 0.73 | SW |
| **GW8** | Puttur | 4.68 | WNW |




| S Code | Locations | Dist (~km) | Dire. |
|---|---|---|---|
| GW1 | Near Project Site | 0.28 | ESE |
| GW2 | Pallalakuppam | 4.53 | NNE |
| GW3 | Krishnampalli | 4.07 | NE |
| GW4 | Vadapuduppatti | 3.71 | E |
| GW5 | Ambur | 7.01 | SSW |
| GW6 | Sattambakkam | 2.20 | SW |
| GW7 | Ottapalaiyam | 0.73 | SW |
| GW8 | Puttur | 4.68 | WNW |

**Figure 3-23 Map showing the groundwater monitoring locations**

**Table 3-15 Physico chemical analysis of Ground water samples from study area**

| S. No | Parameters | Unit | Drinking water Standard (IS 10500: 2012) Acceptable Limit | Drinking water Standard (IS 10500: 2012) Permissible Limit | Near Project Site | Pallalakuppam | Krishnampalli | Vadapudupatti | Ambur | Sattambakkam | Ottapalaiyam | Puttur |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | GW1 | GW2 | GW3 | GW4 | GW5 | GW6 | GW7 | GW8 |
| 1. | Colour | Hazen | 5 | 15 | BLQ(LOQ 1.0) | BLQ(LOQ 1.0) | BLQ(LOQ 1.0) | BLQ(LOQ 1.0) | BLQ(LOQ 1.0) | BLQ(LOQ 1.0) | BLQ(LOQ 1.0) | BLQ(LOQ 1.0) |
| 2. | Turbidity | NTU | 1 | 5 | BLQ(LOQ 0.1) | BLQ(LOQ 0.1) | BLQ(LOQ 0.1) | BLQ(LOQ 0.1) | BLQ(LOQ 0.1) | BLQ(LOQ 0.1) | BLQ(LOQ 0.1) | BLQ(LOQ 0.1) |
| 3. | pH | -- | 6.5-8.5 | NR | 7.33 | 7.54 | 8.16 | 8.21 | 6.55 | 7.79 | 7.65 | 7.14 |
| 4. | Conductivity | µS/cm | - | - | 887.2 | 954.67 | 951.46 | 821.79 | 977.48 | 911.34 | 879.34 | 954.21 |
| 5. | Total Dissolved Solids | mg/l | 500 | 2000 | 623.54 | 749.67 | 711.92 | 631.24 | 754.29 | 745.97 | 641.27 | 801.23 |
| 6. | Total Suspended Solids | mg/l | - | - | BLQ(LOQ 1.0) | BLQ(LOQ 1.0) | BLQ(LOQ 1.0) | BLQ(LOQ 1.0) | BLQ(LOQ 1.0) | BLQ(LOQ 1.0) | BLQ(LOQ 1.0) | BLQ(LOQ 1.0) |
| 7. | Alkalinity as $CaCO_3$ | mg/l | 200 | 600 | 61 | 94 | 107 | 112 | 89 | 127 | 197 | 73 |
| 8. | Total Hardness as $CaCO_3$ | mg/l | 200 | 600 | 145.97 | 211.49 | 327.49 | 219.6 | 249.83 | 287.19 | 194.33 | 251.84 |
| 9. | Sodium as Na | mg/l | - | - | 77.8 | 83.1 | 91.54 | 77.29 | 93.29 | 112.87 | 64.9 | 83.1 |
| 10. | Potassium as K | mg/l | - | - | 5.6 | 8.7 | 6.5 | 7.3 | 10.8 | 5.9 | 8.4 | 9.1 |
| 11. | Calcium as Ca | mg/l | 75 | 200 | 81.24 | 54.69 | 75.24 | 66.17 | 44.39 | 73.49 | 77.98 | 91.71 |
| 12. | Magnesium as Mg | mg/l | 30 | 100 | 45.6 | 39.7 | 66.2 | 31.8 | 43.7 | 54.9 | 26.7 | 37.2 |
| 13. | Chloride as Cl | mg/l | 250 | 1000 | 159.6 | 201.7 | 179.9 | 201.5 | 211.7 | 198.4 | 135.7 | 141.8 |
| 14. | Sulphate $SO_4$ | mg/l | 200 | 400 | 75.8 | 61.9 | 74.5 | 63.5 | 67.24 | 83.7 | 55.9 | 79.2 |
| 15. | Nitrate as $NO_3$ | mg/l | 45 | NR | 4.5 | 4.9 | 5.1 | 4.4 | 5.3 | 6.1 | 2.9 | 3.7 |
| 16. | Fluorides as F | | 1 | 1.5 | 0.33 | 0.49 | 0.71 | 0.55 | 0.61 | 0.74 | 0.39 | 0.41 |
| 17. | Cyanide | mg/l | 0.05 | NR | BLQ(LOQ 0.01) | BLQ(LOQ 0.01) | BLQ(LOQ 0.01) | BLQ(LOQ 0.01) | BLQ(LOQ 0.01) | BLQ(LOQ 0.01) | BLQ(LOQ 0.01) | BLQ(LOQ 0.01) |
| 18. | Arsenic as As | mg/l | 0.01 | 0.05 | BLQ(LOQ 0.005) | BLQ(LOQ 0.005) | BLQ(LOQ 0.005) | BLQ(LOQ 0.005) | BLQ(LOQ 0.005) | BLQ(LOQ 0.005) | BLQ(LOQ 0.005) | BLQ(LOQ 0.005) |
| 19. | Boron as B | mg/l | 0.5 | 1.0 | BLQ(LOQ 0.1) | BLQ(LOQ 0.1) | BLQ(LOQ 0.1) | BLQ(LOQ 0.1) | BLQ(LOQ 0.1) | BLQ(LOQ 0.1) | BLQ(LOQ 0.1) | BLQ(LOQ 0.1) |
| 20. | Cadmium as Cd | mg/l | 0.003 | NR | BLQ(LOQ 0.001) | BLQ(LOQ 0.001) | BLQ(LOQ 0.001) | BLQ(LOQ 0.001) | BLQ(LOQ 0.001) | BLQ(LOQ 0.001) | BLQ(LOQ 0.001) | BLQ(LOQ 0.001) |
| 21. | Chromium as Cr | mg/l | 0.05 | NR | BLQ(LOQ 0.01) | BLQ(LOQ 0.01) | BLQ(LOQ 0.01) | BLQ(LOQ 0.01) | BLQ(LOQ 0.01) | BLQ(LOQ 0.01) | BLQ(LOQ 0.01) | BLQ(LOQ 0.01) |
| 22. | Copper as Cu | mg/l | 0.05 | 1.5 | BLQ(LOQ | BLQ(LOQ | BLQ(LO | BLQ(LOQ | BLQ(LO | BLQ(LOQ | BLQ(LOQ | BLQ(LO |

| S. No | Parameters | Unit | Drinking water Standard (IS 10500: 2012) Acceptable Limit | Drinking water Standard (IS 10500: 2012) Permissible Limit | Near Project Site | Pallalakuppam | Krishnampalli | Vadapudupatti | Ambur | Sattambakkam | Ottapalaiyam | Puttur |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | GW1 | GW2 | GW3 | GW4 | GW5 | GW6 | GW7 | GW8 |
| | | | | | 0.01) | 0.01) | Q 0.01) | 0.01) | Q 0.01) | 0.01) | 0.01) | Q 0.01) |
| **23.** | **Iron as Fe** | **mg/l** | **0.3** | **NR** | 0.164 | 0.154 | 0.138 | 0.165 | 0.172 | 0.124 | 0.132 | 0.16 |
| **24.** | **Lead as Pb** | **mg/l** | **0.01** | **NR** | BLQ(LOQ 0.005) | BLQ(LOQ 0.005) | BLQ(LOQ 0.005) | BLQ(LOQ 0.005) | BLQ(LOQ 0.005) | BLQ(LOQ 0.005) | BLQ(LOQ 0.005) | BLQ(LOQ 0.005) |
| **25.** | **Manganese as Mn** | **mg/l** | **0.1** | **0.3** | BLQ(LOQ 0.05) | BLQ(LOQ 0.05) | BLQ(LOQ 0.05) | BLQ(LOQ 0.05) | BLQ(LOQ 0.05) | BLQ(LOQ 0.05) | BLQ(LOQ 0.05) | BLQ(LOQ 0.05) |
| **26.** | **Mercury** | **mg/l** | **0.001** | **NR** | BLQ(LOQ 0.0005) | BLQ(LOQ 0.0005) | BLQ(LOQ 0.0005) | BLQ(LOQ 0.0005) | BLQ(LOQ 0.0005) | BLQ(LOQ 0.0005) | BLQ(LOQ 0.0005) | BLQ(LOQ 0.0005) |
| **27.** | **Nickel as Ni** | **mg/l** | **0.02** | **NR** | BLQ(LOQ 0.01) | BLQ(LOQ 0.01) | BLQ(LOQ 0.01) | BLQ(LOQ 0.01) | BLQ(LOQ 0.01) | BLQ(LOQ 0.01) | BLQ(LOQ 0.01) | BLQ(LOQ 0.01) |
| **28.** | **Selenium as Se** | **mg/l** | **0.01** | **NR** | BLQ(LOQ 0.005) | BLQ(LOQ 0.005) | BLQ(LOQ 0.005) | BLQ(LOQ 0.005) | BLQ(LOQ 0.005) | BLQ(LOQ 0.005) | BLQ(LOQ 0.005) | BLQ(LOQ 0.005) |
| **29.** | **Zinc as Zn** | **mg/l** | **5** | **15** | BLQ(LOQ 0.1) | BLQ(LOQ 0.1) | BLQ(LOQ 0.1) | BLQ(LOQ 0.1) | BLQ(LOQ 0.1) | BLQ(LOQ 0.1) | BLQ(LOQ 0.1) | BLQ(LOQ 0.1) |

*(**Note:** BLQ – Below the Limit of Quantification; LOQ – Limit of Quantification; NR – No Relaxation)*

**Results and Discussions**

A summary of analytical results are presented below:

- The average pH ranges from 6.55-8.21.
- In the present findings the TDS value varied from 623.54 mg/l to 801.23 mg/l for the ground water and for all samples it exceeds the acceptable limits but within permissible limits of IS 10500: 2012.The acceptable and permissible limit of TDS for drinking water is 500 mg/l and 2000 mg/l.
- The Total hardness ranges between 145.97mg/l – 327.49 mg/l for ground water and for all samples it exceeds the acceptable limit but is within permissible limits of IS 10500: 2012.
- The Total alkalinity as calcium carbonate, Magnesium and Chloride are well within the permissible limits.
- Most of the heavy metals concentrations in the study area samples are below detection limits and all are well within the limits.

## 3.10 Soil as a resource and its Quality

Soils have been classified into

a) Sandy soil
b) Sandy loam
c) Red loam
d) Clay
e) Clayey loam
f) Black cotton soils

The red loamy soils are generally observed at the highest elevations whereas the black cotton soils invariably occupy the valley areas. Other types of soils are found at Intermediate elevations. The pollution from tanneries has caused deterioration of quality of ground water and soil in vast areas. Soil quality monitoring locations & results are given in **Table 3.16 & Table 3.17.** Map showing the soil monitoring locations are given in **Figure 3.24.**

***Source:***http://cgwb.gov.in/District_Profile/TamilNadu/Vellore.pdf
*(**Ref:** District Groundwater Brochure-Vellore District-Central Ground Water Board-January 2009)*

***Note:****Ranipet district was a part of Vellore district before the bifurcation on 28th November 2019. Since secondary sources are available only for Vellore district, however Vellore district comprises Ranipet district details before bifurcation.*

**Table 3-16 Soil & Sediment Quality Monitoring Locations**

| Location Code | Location | Distance (km) from Project boundary | Azimuth Directions |
|---|---|---|---|
| **S1** | Project Site | Within the Site | |
| **S2** | Pallalakuppam | 4.53 | NNE |
| **S3** | Krishnampalli | 4.07 | NE |
| **S4** | Vadapuduppatti | 3.71 | E |
| **S5** | Ambur | 7.01 | SSW |
| **S6** | Sattambakkam | 2.20 | SW |

| | | | |
|---|---|---|---|
| **S7** | Ottapalaiyam | 0.73 | SW |
| **S8** | Puttur | 4.68 | WNW |

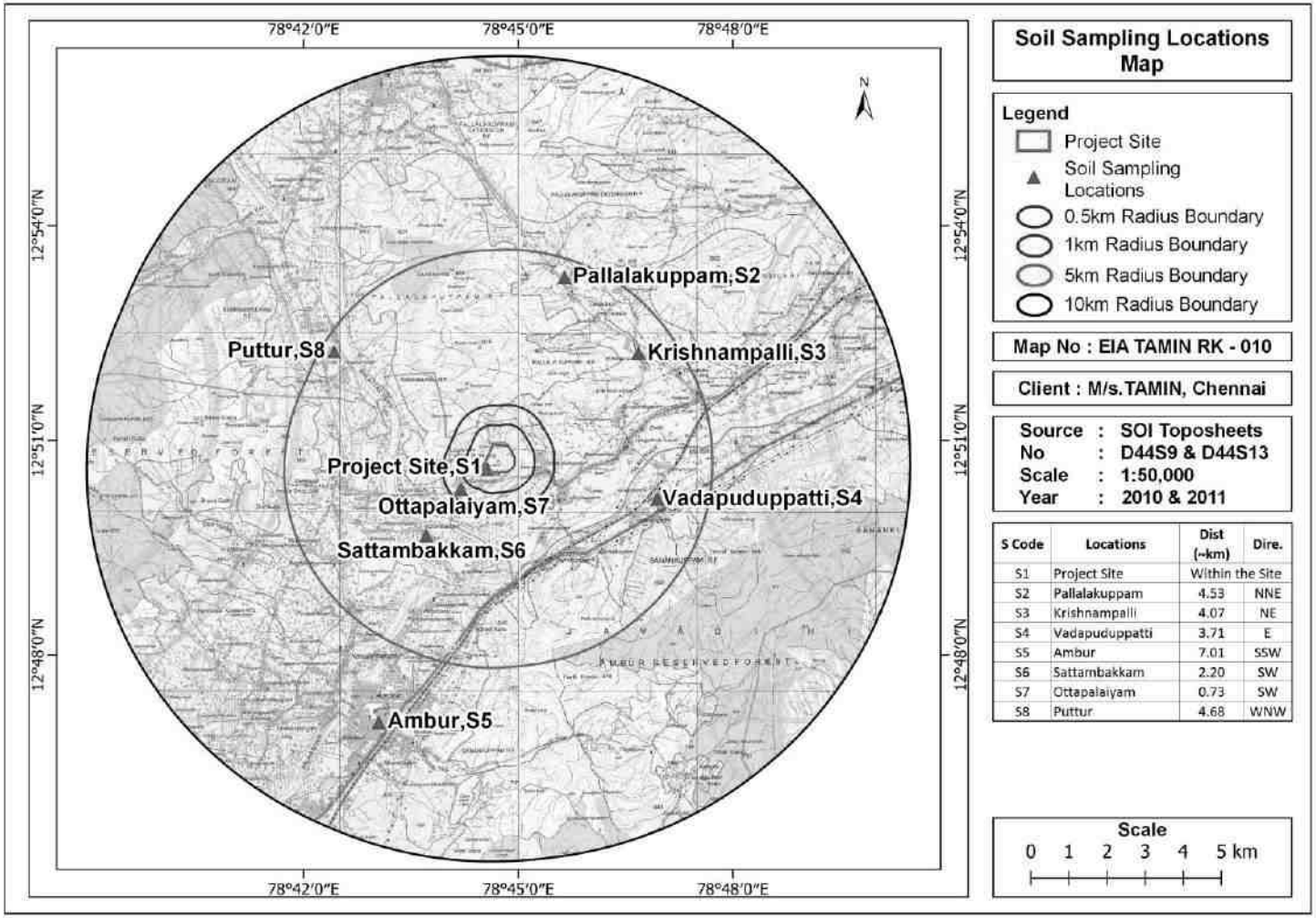



**Figure 3-24 Map showing the soil monitoring location**

**Table 3-17 Soil Quality Monitoring Results**

| S. No | Parameters | Units | Project Site | Pallalakuppam | Krishnampalli | Vadapudupattti | Ambur | Sattambakkam | Ottapalaiyam | Puttur |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | S1 | S2 | S3 | S4 | S5 | S6 | S7 | S8 |
| 1. | Soil Texture | - | Sandy Loam | Loam | Sandy Clay | Sandy Clay loam | Clay loam | Sandy Clay loam | Loam | Sandy Clay loam |
| 2. | Sand | % | 75.2 | 43.5 | 55.2 | 56.7 | 34.1 | 64.7 | 46.2 | 61.8 |
| 3. | Clay | % | 9.8 | 21.2 | 39.8 | 20.3 | 38.3 | 25.1 | 18.3 | 30.5 |
| 4. | Silt | % | 15 | 35.3 | 5 | 23 | 27.6 | 10.2 | 35.5 | 7.7 |
| 5. | pH | - | 7.7 | 8.1 | 6.9 | 7.5 | 7.1 | 8.2 | 7.3 | 6.8 |
| 6. | Electrical conductivity | Umhos/cm | 332 | 297 | 379 | 251 | 230 | 411 | 302 | 264 |
| 7. | Cation Exchange Capacity | meq/100 gm | 2.1 | 3.2 | 2.5 | 2.4 | 3.7 | 4.4 | 3.5 | 2.8 |
| 8. | Nitrogen as N | mg/kg | 233.4 | 215.9 | 198.6 | 211.2 | 254.8 | 177.1 | 285.7 | 294.2 |
| 9. | Phosphorus as P | mg/kg | 119.5 | 102.3 | 100.9 | 114.6 | 132.9 | 98.1 | 140.6 | 156.2 |
| 10. | Potassium as K | mg/kg | 63.7 | 55.1 | 52.6 | 60.9 | 71.6 | 45.9 | 75.2 | 82.3 |
| 11. | Cadmium | mg/kg | BLQ (LOQ 0.1) | BLQ(LOQ 0.1) | BLQ(LOQ 0.1) | BLQ(LOQ 0.1) | BLQ(LOQ 0.1) | BLQ(LOQ 0.1) | BLQ(LOQ 0.1) | BLQ(LOQ 0.1) |
| 12. | Chromium | mg/kg | BLQ (LOQ 0.1) | BLQ(LOQ 0.1) | BLQ(LOQ 0.1) | BLQ(LOQ 0.1) | BLQ(LOQ 0.1) | BLQ(LOQ 0.1) | BLQ(LOQ 0.1) | BLQ(LOQ 0.1) |
| 13. | Porosity | - | 0.22 | 0.25 | 0.33 | 0.21 | 0.36 | 0.4 | 0.24 | 0.23 |
| 14. | Water Holding capacity | (inches of water per foot of soil) | 1.33 | 1.56 | 1.67 | 1.83 | 1.76 | 1.91 | 1.52 | 2.1 |

***Note:*** *BLQ – Below the Limit of Quantification, LOQ – Limit of Quantification.*

### 3.10.1 Results and Discussions

Summary of analytical results

- The pH of the soil samples ranged from 6.8 - 8.2.
- Conductivity of the soil samples ranged from 230 – 411umhos/cm. As the EC value is less than 2000 μS/cm, the soil is found to be non-saline in nature
- Nitrogen content ranged from 177.1mg/kg to 294.2 mg/kg
- Phosphorous ranged from 98.1 mg/kg – 156.2 mg/kg
- Potassium content ranges from 45.9 mg/kg – 82.3 mg/kg.

## 3.11 Biological Environment

An ecological study of the ecosystem is essential to understand the impact of industrialization and urbanization on existing flora and fauna of the study area. Studies on various aspects of ecosystem play an important role in identifying sensitive issues for under taking appropriate action to mitigate the impact, if any. The biological study was under taken as a part of the EIA study report to understand the present status of ecosystem prevailing in the study area, to compare it with past condition with the help of available data, to predict changes in the biological environment as a result of present activities and to suggest measures for maintaining its health. A survey was conducted to study the flora & fauna in 10 km radius. Some of the information was gathered from the local habitants. All the collected data were classified to interpret the impact of pollution on the flora and fauna of that region. Survey of the wild plants as well as cultivated crop plants was made and all the available information was recorded.

During survey, following aspects were considered for ecological studies:

- ❖ Assessment of present status of flora and fauna;
- ❖ Identification of rare and endangered species of plants and animals (if any);
- ❖ Identification of ecologically sensitive areas within the study area;
- ❖ Assessment of migratory route of wildlife (if any); and
- ❖ Assessment of Aquatic Ecology with specific reference to aquatic birds and plankton resources.

### 3.11.1 Methodology

Terrestrial investigations for flora and fauna records were collected by random field survey and a checklist was prepared. During field survey, discussions with the local people were carried-out to collect information related to local biodiversity in and around the area.

### 3.11.2 Floral Study

- ❖ The assessment of the flora of the study area is done by an extensive field survey of the area of 10 Km radius.
- ❖ Plant species were identified based on their specific diagnostics characters of family, genus and species using available floral, other related literature.

- Besides the identification of plant species, information was collected on the vernacular names and uses of plants made by local inhabitants.

### 3.11.3 Faunal Study

Ground surveys are carried out by trekking the study area for identification of important animal groups such as birds, mammals and reptiles for sampling of animals through the following methods.

- For sampling birds/ avifauna 'point sampling' along the fixed transects (foot trails) were done to record all the species of birds with the help of binoculars; field guides and photography for more than 1 hour on each transect (n=4).
- For sampling mammals, 'direct count on open width (20 m) transect' were used on the same transects. Besides, information on recent sightings/records of mammals by the locals are also collected from the study areas.
- Reptiles mainly lizards were sampled by 'direct count on open width transects'.
- Secondary information collected from local villagers, published government data etc.
- List of the endangered and endemic species as per the schedule of The Wildlife Protection Act, 1972.
- Emphasis is given to identify avifauna and mammals to determine the presence and absence of Schedule-1 species, listed in The Wildlife Protection Act 1972, as well as in Red List of IUCN.

### 3.11.4 Floristic composition within the study area

The ecology and diversity survey were conducted in the core area and buffer area extend 10 km radius in the study area. It is observed that human settlements present in and surround the project site and within the study area of 10 km radius vegetation area is in agricultural, horticultural land and private plantation and some natural vegetation observed near the Kallar river and Ammur reserve forest. Total 263 species and 191 genera under 68 familieswere found in the study area. The detailed list of plant species found in each quadrat provided in **Table 3.18.**

**Economically important Flora of the study area**

- **Agricultural crops:** Paddy, Maize is the main crop grown. Different fruits like Banana, papaya, mangoes, guava and vegetables like brinjal, drumsticks, onion, Coriander also grown by the local people.
- **Medicinal plant species:** The near by area is not collected and cultivated medicinal plants but several medicinal plants which are commonly available in the shrub forest and waste lands. The common medicinal plants of the region are including flora table.
- **Rare and endangered floral species:** During the vegetation survey in the study area did not recorded any such species which are endangered or threatened under IUCN (International Union for Conservation of Nature and Natural resources) guidelines.

**Table 3-18 Cumulative List of Floral Species**

| S.No | Botanical Name | Family | Common Name | Habit | IUCN |
|---|---|---|---|---|---|
| 1. | *Abrusprecatorius.* | Papilionaceae | Kunrinmani | Climber | NA |
| 2. | *Abutilon hirtum* | Malvaceae | Thuthi | Shrub | NA |
| 3. | *Abutilon indicum* | Malvaceae | Thuthi | Shrub | NA |

| S.No | Botanical Name | Family | Common Name | Habit | IUCN |
|---|---|---|---|---|---|
| 4. | *Acacia auriculiformis* | Mimosaceae | -- | Tree | LC |
| 5. | *Acacia horrid* | Mimosaceae | Karuvellai | Tree | NA |
| 6. | *Acacia melanoxylon* | Mimosaceae | Chemaivel | Tree | NA |
| 7. | *Acacia nilotica* | Mimosaceae | Karuvelam | Tree | LC |
| 8. | *Acalypha indica* | Euphorbiaceae | Kuppaimeni | Herb | NA |
| 9. | *Acanthospermumhispidum* | Compositae | -- | Herb | NA |
| 10. | *Acanthus ilicifolius* | Acanthaceae | -- | Herb | LC |
| 11. | *Achyranthes aspera* | Amaranthaceae | -- | Herb | NA |
| 12. | *Aegle marmelos* | Rutaceae | Villvamaram | Tree | NA |
| 13. | *Aervalanata* | Amaranthaceae | Kannupulai | Herb | NA |
| 14. | *Aeschynomene aspera* | Papilionaceae | -- | Herb | LC |
| 15. | *Agave cantula* | Agavaceae | Katchalai | Shrub | NA |
| 16. | *Ailanthus excelsa* | Simaroubaceae | -- | Tree | NA |
| 17. | *Albizia lebbeck* | Mimosaceae | Vagai | Tree | NA |
| 18. | *Alloteropsiscimicina* | Poaceae | -- | Grass | NA |
| 19. | *Alocasia macrorrhizos* | Araceae | Semphu | Herb | NA |
| 20. | *Alternanthera pungens* | Amaranthaceae | -- | Herb | NA |
| 21. | *Alternanthera sessilis* | Amaranthaceae | -- | Herb | LC |
| 22. | *Alysicarpusmonilifer* | Papilionaceae | -- | Herb | NA |
| 23. | *Amaranthus roxburghianus* | Amaranthaceae | -- | Herb | NA |
| 24. | *Amaranthus spinosus* | Amaranthaceae | Mullukeerai | Herb | NA |
| 25. | *Amaranthus viridis* | Amaranthaceae | -- | Herb | NA |
| 26. | *Ammaniabaccifera* | Lythraceae | -- | Herb | NA |
| 27. | *Anacardium occidentale* | Anacardiaceae | -- | Tree | NA |
| 28. | *Anisomelesmalabarica* | Labiatae | -- | Shrub | NA |
| 29. | *Apludamutica* | Poaceae | -- | Herb | NA |
| 30. | *Argemone mexicana* | Papaveraceae | -- | Herb | NA |
| 31. | *Aristida setacea* | Poaceae | Variyapul | Herb | NA |
| 32. | *Asparagus racemosus* | Liliaceae | Thaneervitan | Climber | NA |
| 33. | *Asystasiagangetica* | Acanthaceae | -- | Herb | NA |
| 34. | *Axonopuscompressus* | Poaceae | -- | Grass | NA |
| 35. | *Azadirachta indica* | Meliaceae | Veppamaram | Tree | LC |
| 36. | *Bacopa monnieri* | Scrophulariaceae | -- | Herb | LC |
| 37. | *Barlerialongiflora* | Acanthaceae | -- | Herb | NA |
| 38. | *Barringtonia acutangula* | Barringtoniaceae | Neermaruthu | Tree | LC |
| 39. | *Bauhinia racemosa* | Caesalpiniaceae | -- | Tree | NA |
| 40. | *Bidens pilosa* | Compositae | -- | Herb | NA |
| 41. | *Biophytumsensitivum* | Oxalidaceae | -- | Herb | NA |
| 42. | *Blepharismaderaspatensis* | Acanthaceae | -- | Herb | NA |
| 43. | *Blumeaobliqua* | Compositae | -- | Herb | NA |
| 44. | *Boerhaviadiffusa* | Nyctaginaceae | -- | Herb | NA |
| 45. | *Boerhaviaerecta* | Nyctaginaceae | -- | Herb | NA |
| 46. | *Borassus flabellifer* | Arecaceae | Panaimaram | Tree | LC |
| 47. | *Brachiariamutica* | Poaceae | -- | Grass | LC |
| 48. | *Calotropis gigantea* | Asclepiadaceae | Erukku | Shrub | NA |
| 49. | *Canavalia rosea* | Papilionaceae | Kattuavarai | Climber | NA |
| 50. | *Cardiospermum halicacabum* | Sapindaceae | -- | Climber | LC |
| 51. | *Cascabelathevetia* | Apocynaceae | -- | Shrub | LC |
| 52. | *Cassia absus* | Caesalpiniaceae | -- | Herb | LC |
| 53. | *Cassia alata* | Caesalpiniaceae | -- | Shrub | LC |
| 54. | *Cassia auriculata* | Caesalpiniaceae | Avarrai | Shrub | NA |

| S.No | Botanical Name | Family | Common Name | Habit | IUCN |
|---|---|---|---|---|---|
| 55. | *Cassia fistula* | Caesalpiniaceae | -- | Tree | LC |
| 56. | *Cassia nigricans* | Caesalpiniaceae | -- | Herb | NA |
| 57. | *Cassia occidentalis* | Caesalpiniaceae | -- | Herb | NA |
| 58. | *Cassia senna* | Caesalpiniaceae | -- | Herb | NA |
| 59. | *Cassia tora* | Caesalpiniaceae | -- | Herb | NA |
| 60. | *Catharanthus roseus* | Apocynaceae | Nithiyakalyani | Herb | NA |
| 61. | *Catunaregam spinosa* | Rubiaceae | -- | Shrub | NA |
| 62. | *Celosia argentea* | Amaranthaceae | -- | Herb | LC |
| 63. | *Cenchrus ciliaris* | Poaceae | -- | Herb | LC |
| 64. | *Centella asiatica* | Apiaceae | Vallarai | Herb | LC |
| 65. | *Centipeda minima* | Asteraceae | -- | Herb | LC |
| 66. | *Chloris barbata* | Poaceae | -- | Grass | NA |
| 67. | *Chromolaena odorata* | Compositae | -- | Shrub | NA |
| 68. | *Cissus quadrangularis* | Vitaceae | Pirandai | Climber | NA |
| 69. | *Citrullus colocynthis* | Cucurbitaceae | -- | Herb | NA |
| 70. | *Cleome aspera* | Cleomaceae | Naikadugu | Herb | NA |
| 71. | *Cleome viscose* | Cleomaceae | Naikaduku | Herb | NA |
| 72. | *Clerodendruminerme* | Verbenaceae | -- | Herb | NA |
| 73. | *Clerodendrumphlomidis* | Verbenaceae | -- | Shrub | NA |
| 74. | *Clitoriaternatea* | Papilionaceae | Sangupoo | Climber | NA |
| 75. | *Coccinia grandis* | Cucurbitaceae | Kovaikai | Climber | NA |
| 76. | *Cocculus hirsutus* | Menispermaceae | Kattukodi | Climber | NA |
| 77. | *Coldenia procumbens* | Boraginaceae | -- | Herb | LC |
| 78. | *Commelinabenghalensis* | Commelinaceae | -- | Herb | LC |
| 79. | *Commelinadiffusa* | Commelinaceae | -- | Herb | LC |
| 80. | *Commelinaerecta* | Commelinaceae | -- | Herb | LC |
| 81. | *Commelinahasskarlli* | Commelinaceae | -- | Herb | NA |
| 82. | *Commiphoraberryi* | Burseraceae | -- | Shrub | NA |
| 83. | *Corchorus aestuans* | Tiliaceae | -- | Herb | NA |
| 84. | *Corchorus tridens* | Tiliaceae | -- | Herb | NA |
| 85. | *Corchorus urticifolius* | Tiliaceae | -- | Herb | NA |
| 86. | *Cordia oblique* | Boraginaceae | -- | Tree | NA |
| 87. | *Crinum asiaticum* | Amarayllidaceae | -- | Herb | NA |
| 88. | *Crotalaria juncea* | Papilionaceae | -- | Shrub | NA |
| 89. | *Crotalaria retusa* | Papilionaceae | -- | Shrub | NA |
| 90. | *Crotalaria verrucosa* | Papilionaceae | -- | Shrub | NA |
| 91. | *Croton bonplandianum* | Euphorbiaceae | -- | Herb | NA |
| 92. | *Ctenolepisgarcinii* | Cucurbitaceae | -- | Climber | NA |
| 93. | *Cynodondactylon* | Poaceae | Arugampul | Grass | NA |
| 94. | *Cyperus arenarius* | Cyperaceae | Korai | Sedge | LC |
| 95. | *Cyperus brevifolius* | Cyperaceae | -- | Sedge | LC |
| 96. | *Cyperus cephalotes* | Cyperaceae | -- | Sedge | LC |
| 97. | *Cyperus compressus* | Cyperaceae | -- | Sedge | LC |
| 98. | *Cyperus corymbosus* | Cyperaceae | -- | Sedge | LC |
| 99. | *Cyperus difformis* | Cyperaceae | -- | Sedge | LC |
| 100. | *Cyperus digitatus* | Cyperaceae | -- | Sedge | LC |
| 101. | *Cyperus exaltatus* | Cyperaceae | -- | Sedge | LC |
| 102. | *Cyperus halpan* | Cyperaceae | -- | Sedge | LC |
| 103. | *Cyperus hyalinus* | Cyperaceae | -- | Sedge | NA |
| 104. | *Cyperus iria* | Cyperaceae | -- | Sedge | LC |
| 105. | *Cyperus nutans* | Cyperaceae | -- | Sedge | LC |

| S.No | Botanical Name | Family | Common Name | Habit | IUCN |
|---|---|---|---|---|---|
| 106. | *Cyperus paniceus* | Cyperaceae | -- | Sedge | LC |
| 107. | *Cyperus polystachyos* | Cyperaceae | -- | Sedge | LC |
| 108. | *Cyperus rotundus* | Cyperaceae | -- | Sedge | LC |
| 109. | *Cyrtococcumlongipes* | Poaceae | -- | Grass | NA |
| 110. | *Dacytlocteniumaegyptium* | Poaceae | -- | Grass | NA |
| 111. | *Datura metal* | Solanaceae | Umathai | Herb | NA |
| 112. | *Dichrostachys cinerea* | Mimosaceae | -- | Tree | LC |
| 113. | *Digitariaabludens* | Poaceae | -- | Grass | NA |
| 114. | *Digitariaciliaris* | Poaceae | -- | Grass | NA |
| 115. | *Ecliptaprostrata* | Asteraceae | -- | Herb | LC |
| 116. | *Eichhornia crassipes* | Pontederiaceae | -- | Herb | NA |
| 117. | *Eleocharis spiralis* | Cyperaceae | -- | Sedge | LC |
| 118. | *Eleusine indica* | Poaceae | -- | Grass | LC |
| 119. | *Elytraria acaulis* | Acanthaceae | -- | Herb | NA |
| 120. | *Eragrostis aspera* | Poaceae | -- | Grass | NA |
| 121. | *Eragrostis japonica* | Poaceae | -- | Grass | LC |
| 122. | *Eragrostistenella* | Poaceae | -- | Grass | NA |
| 123. | *Eragrostisunioloides* | Poaceae | -- | Grass | LC |
| 124. | *Eriocaulon thwaitesii* | Eriocaulaceae | -- | Herb | LC |
| 125. | *Eriochloaprocera* | Poaceae | -- | Grass | LC |
| 126. | *Eriochrysisrangacharii* | Poaceae | -- | Grass | NA |
| 127. | *Euphorbia hirta* | Euphorbiaceae | Ammanpacharici | Herb | NA |
| 128. | *Evolvulusalsinoides* | Convolvulaceae | -- | Herb | NA |
| 129. | *Ficus benghalensis* | Moraceae | Allamaram | Tree | NA |
| 130. | *Ficus religiosa* | Moraceae | Arasamaram | Tree | NA |
| 131. | *Fimbristylisaestivalis* | Cyperaceae | -- | Sedge | NA |
| 132. | *Fimbristylis argentea* | Cyperaceae | -- | Sedge | LC |
| 133. | *Fimbristylisdichotoma* | Cyperaceae | -- | Sedge | LC |
| 134. | *Fimbristylisferruginea* | Cyperaceae | -- | Sedge | LC |
| 135. | *Fimbristylismiliacea* | Cyperaceae | -- | Sedge | NA |
| 136. | *Gomphrena serrata* | Amaranthaceae | Kattuvadamalli | Herb | NA |
| 137. | *Hedyotiscorymbosa* | Rubiaceae | -- | Herb | NA |
| 138. | *Hedyotispuberula* | Rubiaceae | -- | Herb | NA |
| 139. | *Heliotropium indicum* | Boraginaceae | Thelkodukku | Herb | NA |
| 140. | *Hemidesmus indicus* | Periplocaceae | Nannari | Herb | NA |
| 141. | *Heteropogoncontortus* | Poaceae | -- | Herb | NA |
| 142. | *Hibiscus micranthus* | Malvaceae | -- | Herb | NA |
| 143. | *Hybanthusenneaspermus* | Violaceae | -- | Herb | NA |
| 144. | *Hydrilla verticillata* | Hydrocharifaceae | -- | Herb | LC |
| 145. | *Hygrophila auriculata* | Acanthaceae | Neermul | Herb | LC |
| 146. | *Hygroryzaaristata* | Poaceae | -- | Grass | NA |
| 147. | *Hyptissuaveolens* | Labiatae | -- | Shrub | NA |
| 148. | *Indigofera linnaei* | Papilionaceae | -- | Herb | NA |
| 149. | *Indigofera tinctoria* | Papilionaceae | -- | Shrub | NA |
| 150. | *Indotristicharamosissima* | Podostemaceae | -- | Herb | LC |
| 151. | *Ipomoea aquatica* | Convolvulaceae | -- | Climber | LC |
| 152. | *Ipomoea carnea* | Convolvulaceae | -- | Shrub | NA |
| 153. | *Ipomoea obscura* | Convolvulaceae | -- | Climber | NA |
| 154. | *Ipomoea pes-tigridis* | Convolvulaceae | -- | Climber | NA |
| 155. | *Isachnemiliacea* | Poaceae | -- | Grass | NA |
| 156. | *Ischaemumtimorense* | Poaceae | -- | Grass | NA |

| S.No | Botanical Name | Family | Common Name | Habit | IUCN |
|---|---|---|---|---|---|
| 157. | *Ischeamum indicum* | Poaceae | -- | Grass | NA |
| 158. | *Jatropha gossypifolia* | Euphorbiaceae | Kattuamanaku | Shrub | NA |
| 159. | *Justicia glauca* | Acanthaceae | -- | Herb | NA |
| 160. | *Kyllingasquamulata* | Cyperaceae | -- | Sedge | NA |
| 161. | *Lanneacoromandelica* | Anacardiaceae | -- | Tree | NA |
| 162. | *Lantana camara* | Verbenaceae | -- | Shrub | NA |
| 163. | *Leersiahexandra* | Poaceae | -- | Grass | LC |
| 164. | *Lemnagibba* | Lemnaceae | -- | Herb | LC |
| 165. | *Lemnaperpusilla* | Lemnaceae | -- | Herb | LC |
| 166. | *Leucaena leucocephala* | Mimosaceae | -- | Tree | NA |
| 167. | *Leucas aspera* | Labiatae | -- | Herb | NA |
| 168. | *Limnophila heterophylla* | Scrophulariaceae | -- | Herb | LC |
| 169. | *Limnophila indica* | Scrophulariaceae | -- | Herb | LC |
| 170. | *Lindenbergia indica* | Scrophulariaceae | -- | Herb | LC |
| 171. | *Linderniaantipoda* | Scrophulariaceae | -- | Herb | LC |
| 172. | *Linderniacaespitosa* | Scrophulariaceae | -- | Herb | LC |
| 173. | *Lindernia crustacea* | Scrophulariaceae | -- | Herb | LC |
| 174. | *Linderniaoppositifolia* | Scrophulariaceae | -- | Herb | LC |
| 175. | *Ludwigiaadscendens* | Onagraceae | -- | Herb | NA |
| 176. | *Ludwigia perennis* | Onagraceae | -- | Herb | LC |
| 177. | *Mangifera indica* | Anacardiaceae | Mamaram | Tree | DD |
| 178. | *Melia azedarach* | Meliaceae | Kattuvempoo | Tree | LC |
| 179. | *Merremia hederacea* | Convolvulaceae | -- | Climber | NA |
| 180. | *Mollugo pentaphylla* | Molluginaceae | -- | Herb | NA |
| 181. | *Monochoria vaginalis* | Pontederiaceae | -- | Herb | LC |
| 182. | *Morindapubescens* | Rubiaceae | Manjanathi | Tree | NA |
| 183. | *Mukiamaderaspatana* | Cucurbitaceae | -- | Climber | NA |
| 184. | *Murdannia pauciflora* | Commelinaceae | -- | Herb | LC |
| 185. | *Nelumbo nucifera* | Nelumbonaceae | Thamarai | Herb | NA |
| 186. | *Nymphaea nouchali* | Nymphaeaceae | -- | Herb | LC |
| 187. | *Nymphaea pubescens* | Nymphaeaceae | Alli | Herb | LC |
| 188. | *Oplismenuscompositus* | Poaceae | -- | Grass | NA |
| 189. | *Oryza sativa* | Poaceae | Nellu | Grass | LC |
| 190. | *Otteliaalismoides* | Hydrocharitaceae | -- | Herb | LC |
| 191. | *Pandanus fascicularis* | Pandanaceae | Thallai | Shrub | NA |
| 192. | *Panicum repens* | Poaceae | -- | Grass | LC |
| 193. | *Panicum trypheron* | Poaceae | -- | Grass | NA |
| 194. | *Paspalidiumgeminatum* | Poaceae | -- | Grass | LC |
| 195. | *Paspalum conjugatum* | Poaceae | -- | Grass | LC |
| 196. | *Paspalum scrobiculatum* | Poaceae | -- | Grass | LC |
| 197. | *Passiflora foetida* | Passifloraceae | -- | Climber | NA |
| 198. | *Pavonia odorata* | Malvaceae | -- | Herb | NA |
| 199. | *Pedalium murex* | Pedaliaceae | -- | Herb | NA |
| 200. | *Pennisetum polystachion* | Poaceae | -- | Grass | LC |
| 201. | *Pentatropis capensis* | Asclepiadaceae | -- | Climber | NA |
| 202. | *Pergulariadaemia* | Asclepiadaceae | -- | Climber | NA |
| 203. | *Peristrophepaniculata* | Acanthaceae | -- | Herb | NA |
| 204. | *Perotis indica* | Poaceae | -- | Herb | NA |
| 205. | *Phoenix loureirii* | Arecaceae | -- | Tree | NA |
| 206. | *Phyla nodiflora* | Verbenaceae | -- | Herb | LC |
| 207. | *Phyllanthus amarus* | Euphorbiaceae | -- | Herb | NA |

| S.No | Botanical Name | Family | Common Name | Habit | IUCN |
|---|---|---|---|---|---|
| 208. | *Phyllanthus reticulatus* | Euphorbiaceae | -- | Shrub | NA |
| 209. | *Pistia stratiotes* | Araceae | -- | Herb | LC |
| 210. | *Pithecellobium dulce* | Mimosaceae | -- | Tree | LC |
| 211. | *Plygonumglabrum* | Polygonaceae | -- | Herb | NA |
| 212. | *Polygonum barbatum* | Polygonaceae | -- | Herb | LC |
| 213. | *Pongamia pinnata* | Papilionaceae | Pungammaram | Tree | LC |
| 214. | *Portulaca oleracea* | Portulacaceae | -- | Herb | NA |
| 215. | *Prosopis juliflora* | Mimosaceae | Seemaikaruvai | Tree | NA |
| 216. | *Rhizophora mucronata* | Rhizophoraceae | -- | Herb | LC |
| 217. | *Rhynchelytrum repens* | Poaceae | -- | Grass | NA |
| 218. | *Rhynchosporacorymbosa* | Cyperaceae | -- | Sedge | LC |
| 219. | *Riveahypocrateriformis* | Convolvulaceae | -- | Climber | NA |
| 220. | *Ruellia tuberosa* | Acanthaceae | -- | Herb | NA |
| 221. | *Rungiapectinata* | Acanthaceae | -- | Herb | NA |
| 222. | *Saccharum spontaenum* | Poaceae | Naanal | Grass | NA |
| 223. | *Sacciolepis indica* | Poaceae | -- | Grass | NA |
| 224. | *Sarcostemmasecamone* | Asclepiadaceae | Pallchedi | Herb | NA |
| 225. | *Scirpusarticulatus* | Cyperaceae | -- | Sedge | LC |
| 226. | *Securinegaleucopyrus* | Euphorbiaceae | -- | Shrub | NA |
| 227. | *Setaria intermedia* | Poaceae | -- | Grass | NA |
| 228. | *Setariaverticillata* | Poaceae | -- | Grass | NA |
| 229. | *Sida acuta* | Malvaceae | -- | Herb | NA |
| 230. | *Sida cordata* | Malvaceae | -- | Herb | NA |
| 231. | *Sida cordifolia* | Malvaceae | -- | Herb | NA |
| 232. | *Solanum americanum* | Solanaceae | -- | Herb | NA |
| 233. | *Solanum nigrum* | Solanaceae | -- | Herb | NA |
| 234. | *Solanum trilobatum* | Solanaceae | -- | Climber | NA |
| 235. | *Solanum virginianum* | Solanaceae | -- | Herb | NA |
| 236. | *Sopubiadelphiniifolia* | Scrophulariaceae | -- | Herb | NA |
| 237. | *Spermacocehispida* | Rubiaceae | -- | Herb | NA |
| 238. | *Sphaeranthusamaranthoides* | Compositae | -- | Herb | LC |
| 239. | *Sphaeranthus indicus* | Compositae | -- | Herb | LC |
| 240. | *Sporobolus indicus* | Poaceae | -- | Grass | NA |
| 241. | *Sporobolus maderaspatanus* | Poaceae | -- | Grass | NA |
| 242. | *Stachytarphetajamaicensis* | Verbenaceae | -- | Herb | NA |
| 243. | *Syzygiumcumini* | Myrtaceae | -- | Tree | LC |
| 244. | *Tamarindus indica* | Caesalpiniaceae | Puliyamaram | Tree | LC |
| 245. | *Taragiaplukeneti* | Euphorbiaceae | -- | Herb | NA |
| 246. | *Tephrosia purpurea* | Papilionaceae | -- | Herb | LC |
| 247. | *Tephrosia villosa* | Papilionaceae | -- | Herb | LC |
| 248. | *Terminalia arjuna* | Combretaceae | -- | Tree | NA |
| 249. | *Thespesia populnea* | Malvaceae | -- | Tree | LC |
| 250. | *Tinospora cordifolia* | Menispermaceae | -- | Climber | NA |
| 251. | *Trapa natans* | Trapaceae | -- | Herb | LC |
| 252. | *Tribulus terrestris* | Zygophyllaceae | -- | Herb | NA |
| 253. | *Trichodesma indicum* | Boraginaceae | -- | Herb | NA |
| 254. | *Tridax procumbens* | Compositae | -- | Herb | NA |
| 255. | *Tylophora indica* | Asclepiadaceae | -- | Climber | NA |
| 256. | *Typha angustata* | Typhaceae | -- | Herb | LC |
| 257. | *Utricularia aurea* | Lentibulariaceae | -- | Herb | LC |
| 258. | *Vallisneria natans* | Hydrocharitaceae | -- | Herb | LC |

| S.No | Botanical Name | Family | Common Name | Habit | IUCN |
|---|---|---|---|---|---|
| 259. | *Vernonia cinerea* | Compositae | -- | Herb | NA |
| 260. | *Waltheria indica* | Sterculiaceae | -- | Herb | NA |
| 261. | *Xanthium indicum* | Compositae | -- | Herb | NA |
| 262. | *Ziziphus mauritiana* | Rhamnaceae | -- | Shrub | NA |
| 263. | *Zornia diphylla* | Papilionaceae | -- | Herb | NA |

*(LC-Least Concern, DD-Data deficient, CR-Critically Endangered, VU-Vulnerable, NA-Not yet assessed, EN- Endangered, NT-Near Threatened, EW- Extinct in the Wild).*

### 3.11.5 Fauna Diversity

Both direct (sighting) and indirect (evidences) observations methods were used to survey the faunal species around the study area. Additionally, reference of relevant literatures (published/unpublished) and dialogues with local villagers were also carried out to consolidate the presence of faunal distribution in the area (Smith 1933-43, Ali and Ripley 1983, Daniel 1983, Prater 1993, Murthy and Chandrasekhar 1988).

### 3.11.6 Bird **species**

Total 117 bird species belonging to 42 families were recorded during Pre-Monsoon study period are provided in **Table 3.19.**

**Table 3-19 List of Birds species in the Study Area**

| S.No | Scientific Name | Common Name | Family Name | IUCN |
|---|---|---|---|---|
| 1. | *Pelecanusphilippensis* | Spotted billed Pelican | Pelicanidae | NT |
| 2. | *Phalacrocoraxniger* | Little Cormorant | Phalacrocoracidae | LC |
| 3. | *Phalacrocoaxcarbo* | Large Cormorant | Phalacrocoracidae | NA |
| 4. | *Phalacrocofusciollis* | Indian Shag | Phalacrocoracidae | |
| 5. | *Anhinga rufa* | Darter or Snake Bird | Phalacrocoracidae | LC |
| 6. | *Ardea alba* | Large Egret | Ardeidae | LC |
| 7. | *Bubulcus ibis* | Cattle Egret | Ardeidae | LC |
| 8. | *Egretta intermedia* | Median or Smaller Egret | Ardeidae | |
| 9. | *Egrettagarzetta* | Little Egret | Ardeidae | LC |
| 10. | *Ardea purpurea* | Purple heron | Ardeidae | LC |
| 11. | *Ardea cinerea* | Grey Heron | Ardeidae | LC |
| 12. | *Ardealastriatus* | Little Green Heron | Ardeidae | |
| 13. | *Ardealagrayii* | Paddy bird or Pond Heron | Ardeidae | |
| 14. | *Ixobrychuscinnamomeus* | Chestnut Bittern | Ardeidae | LC |
| 15. | *Ixobrychus sinensis* | Yellow Bittern | Ardeidae | LC |
| 16. | *Ixobrychusflavicollis* | Black Bittern | Ardeidae | LC |
| 17. | *Mycteria leucocephala* | Painted Stork | Ciconidae: | NT |
| 18. | *Anastomusoscitans* | Openbill Stork | Ciconidae: | LC |
| 19. | *Threskiornis aethiopica* | White Ibis | Threskiornithidae | |
| 20. | *Plegadisfalcinellus* | Glossy Ibis | Threskiornithidae | LC |
| 21. | *Elanus caeruleus* | Blackwinged Kite | Accipitridae | LC |
| 22. | *Haliastur Indus* | Brahminy Kite | Accipitridae | LC |

| | | | | |
|---|---|---|---|---|
| 23. | *Pernis ptilorhyncus* | Honey Buzzard | Accipitridae | LC |
| 24. | *Accipiter badius* | Shikra | Accipitridae | LC |
| 25. | *Aquila clanga* | Greater spotted eagle (vu) | Accipitridae | VU |
| 26. | *Hieraaetuspennatus* | Booted Hawk-Eagle | Accipitridae | LC |
| 27. | *Circus pygargus* | Montagu's harrier | Accipitridae | LC |
| 28. | *Circus aeruginosus** | Marsh Harrier | Accipitridae | LC |
| 29. | *Circus macrourus* | Pale harrier | Accipitridae | NT |
| 30. | *Falco tinnunculus* | Kestrel | Falconidae | LC |
| 31. | *Francolinuspondicerianus* | Grey Partridge | Phasianidae | LC |
| 32. | *Pavocristatus* | Common Peafowl | Phasianidae | LC |
| 33. | *Fulicaatra* | Coot | Rallidae | LC |
| 34. | *Streptopeliadecaocto* | Ring Dove | Columbidae | LC |
| 35. | *Streptopelia chinensis* | Spotted Dove | Columbidae | |
| 36. | *Streptopelia senegalensis* | Little Brown dove | Columbidae | LC |
| 37. | *Streptopeliatranquebarica* | Red turtle dove | Columbidae | LC |
| 38. | *Chalcophaps indica* | Emerald or Bronzewinged Dove | Columbidae | LC |
| 39. | *Psittaculakrameri* | Roseringed Parakeet | Psittacidae | LC |
| 40. | *Caculusvarius* | Common Brainfever Bird | Cuculidae | |
| 41. | *Clamatorjacobinus* | Pied Crested Cuckoo | Cuculidae | LC |
| 42. | *Eudynamysscolopacea* | Koel | Cuculidae | LC |
| 43. | *Tyto alba* | Barn or Screech owl | Strigidae | LC |
| 44. | *Apus melba* | Alpine swift | Apodidae | LC |
| 45. | *Apus affinis* | House Swift | Apodidae | LC |
| 46. | *Cypsiurusparvus* | Palm Swift | Apodidae | LC |
| 47. | *Cerylerudis* | Pied Kingfisher | Alcedinidae | LC |
| 48. | *Alcedoatthis* | Small Blue Kingfisher | Alcedinidae | LC |
| 49. | *Halcyon smyrnensis* | White-breasted Kingfisher | Alcedinidae | LC |
| 50. | *Meropsphilippinus* | Bluetailed Bee-Eater | Meropidae | LC |
| 51. | *Meropsorientalis* | Green Bee-Eater | Meropidae | LC |
| 52. | *Coracias benghalensis* | Indian roller Or Bluejay | Coracidae | LC |
| 53. | *Upupa epops* | Hoopoe | Upupidae | LC |
| 54. | *Megalaimahaemacephala* | Crimsonbreasted Barbet | Capitonidae | LC |
| 55. | *Megalaimaviridis* | White-Cheeked Barbet | Capitonidae | LC |
| 56. | *Dinopiumbenghalense* | Lesser Woodpecker | Picidae | LC |
| 57. | *Pitta brachyuran* | Indian Pitta | Pittidae | |
| 58. | *Eremopterix grisea* | Ashycrowned Finch-Lark | Alaudidae | LC |
| 59. | *Mirafraerythroptera* | Redwinged Bushlark | Alaudidae | LC |
| 60. | *Mirafrajavanica* | Singing Bush Lark | Alaudidae | LC |
| 61. | *Hirundorustica* | Swallow | Hirundinidae | LC |

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|---|---|---|---|---|
| 62. | *Hirundosmithii* | Wiretailed Swallow | Hirundinidae | LC |
| 63. | *Hirundodaurica* | Redrumped Swallow | Hirundinidae | |
| 64. | *Hirundodaurica* | Striated Or Red-Rumped Swallow | Hirundinidae | |
| 65. | *Laniusvittatus* | Baybacked Shrike | Danidae | LC |
| 66. | *Laniuscristatus* | Brown Shrike | Danidae | LC |
| 67. | *Oriolusoriolus* | Golden Oriole | Oriolidae | LC |
| 68. | *Dicrurusadsimilis* | Black Drongo Or King-Crow | Dicruridae | LC |
| 69. | *Dicrurusleucophaeus* | Grey Or Ashy Drongo | Dicruridae | LC |
| 70. | *Artamusfuscus* | Ashy Swallow-Shrike | Artamidae | LC |
| 71. | *Sturnus malabaricus* | Greyheaded Myna | Sturnidae | LC |
| 72. | *Sturnus pagodarum* | Brahminy,Myna | Sturnidae | LC |
| 73. | *Sturnus roseus* | Rosy Pastor | Sturnidae | LC |
| 74. | *Acridotheres tristis* | Common Myna | Sturnidae | LC |
| 75. | *Dendrocittavagabunda* | Tree Pie | Corvidae | LC |
| 76. | *Corvus splendens* | House Crow | Corvidae | LC |
| 77. | *Corvus macrorhynchos* | Jungle Crow | Corvidae | LC |
| 78. | *Tephrodornispondicerianus* | Common Wood Shrike | Campephagidae | LC |
| 79. | *Coracinamelanoptera* | Black-Headed Cuckoo-Shrike | Campephagidae | LC |
| 80. | *Pericrocotuscinnamomeus* | Small Minivet | Campephagidae | LC |
| 81. | *Aegithina tiphia* | Common Iora | Irenidae | LC |
| 82. | *Pycnonotuscafer* | Redvented Bulbul | Pycnonotidae | LC |
| 83. | *Pycnonotusluteolus* | Whitebrowed Bulbul | Pycnonotidae | LC |
| 84. | *Pomatorhinushorsefieldi* | Slaty-Headed Scimitar Babbler | Muscicapidae | |
| 85. | *Turdoldesmalcolmi* | Large Grey Babbler | Muscicapidae | |
| 86. | *Turdoidesaffinis* | Whiteheaded Babbler | Muscicapidae | LC |
| 87. | *Muscicapalatirostris* | Brown Flycatcher | Subfamily:Muscicapinae | |
| 88. | *Terpsiphone paradise* | Paradise Flycatcher | Subfamily:Muscicapinae | |
| 89. | *Priniasubflava* | Plain Wren Warbler | Subfamily:Sylviinae | LC |
| 90. | *Priniasocialis* | Ashy Wren Warbler | Subfamily:Sylviinae | LC |
| 91. | *Orthotomussutorius* | Tailor Bird | Subfamily:Sylviinae | LC |
| 92. | *Acrocephalusstentoreus* | Indian Great Reed Warbler | Subfamily:Sylviinae | LC |
| 93. | *Acrocephalusdumetorum* | Blyth's Read Warbler | Subfamily:Sylviinae | LC |
| 94. | *Acrocephalus Agricola* | Paddy Field Warbler | Subfamily:Sylviinae | LC |
| 95. | *Sylvia curruca* | Orphean Warbler | Subfamily:Sylviinae | LC |
| 96. | *Phylloscopusmagnirostris* | Large Billed Leaf Warbler | Subfamily:Sylviinae | LC |
| 97. | *Phylloscopustrochiloides* | Greenish Leaf Warbler | Subfamily:Sylviinae | LC |
| 98. | *Copsychussaularis* | Magpie Robin | Subfamily:Turdinae | LC |
| 99. | *Saxicoloidesfulicata* | Indian Robin | Subfamily:Turdinae | LC |
| 100. | *Anthusnovaeseelandiae* | Paddyfield Pipit | Moticillidae | LC |
| 101. | *Motacilla indica* | Forest Wagtail | Moticillidae | |
| 102. | *Motacilla flava* | Yellow Wagtail | Moticillidae | LC |

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|---|---|---|---|---|
| 103. | *Motacillacitreola* | Citrine Wagtail | Moticillidae | LC |
| 104. | *Motacilla cinerea* | Grey Wagtail | Moticillidae | LC |

*(LC-Least Concern, DD-Data deficient, CR-Critically Endangered, VU-Vulnerable, NA-Not yet assessed, EN- Endangered, NT-Near Threatened, EW- Extinct in the Wild).*

### 3.11.7 Mammals

No wild mammalian species were directly sighted during the field survey. Dialogue with local villagers located around the study area also could not confirm presence of any wild animal in that area.

**Table 3-20 Mammals recorded in the Study area and their Conservation Status**

| S.No | Species name | Common name | IUCN Conservation Status |
|---|---|---|---|
| **1.** | *Eutropismacularia* | Common skink | Not assessed |
| **2.** | *Plyasmucosus* | Rat Snake | Not assessed |
| **3.** | *Nerodiasipedon* | Fresh water snake | Not assessed |
| **4.** | *Rana tigrina* | Common yellow frog | Least Concern |
| **5.** | *Calotes versicolor* | Common Garden Lizard | Not assessed |
| **6.** | *Hemidactylus sp.* | House lizard | Not assessed |
| **7.** | *Ophisopsleschenaultiix* | Snake-eyed lizard | Not assessed |
| **8.** | *Rana hexadactyla* | Frog | Least Concern |

*(LC-Least Concern, DD-Data deficient, CR-Critically Endangered, VU-Vulnerable, NA-Not yet assessed, EN- Endangered, NT-Near Threatened, EW- Extinct in the Wild).*

### 3.11.8 Reptiles& Amphibians

Reptiles and amphibian species were recorded in this area through directly sighted during the field survey.

**Table 3-21 Reptiles & Amphibians recorded in the Study area andtheir Conservation Status**

| S.No | Species name | Common name | IUCN Conservation Status |
|---|---|---|---|
| 1. | Mus musculus | Common Mouse | Not assessed |
| 2. | Funambulus pennanti | Palm -Squirrel | Not assessed |
| 3. | Mus rattus | Indian rat | Not assessed |
| 4. | Lepus nigricollis | Indian Hare | Least Concern |
| 5. | Rattus norvegicus | Brown Rat | Least Concern |
| 6. | Felis catus | Cat | Not assessed |

*(LC-Least Concern, DD-Data deficient, CR-Critically Endangered, VU-Vulnerable, NA-Not yet assessed, EN- Endangered, NT-Near Threatened, EW- Extinct in the Wild).*

### 3.11.9 Butterfly Species

Butterfly can also serve as useful indicators of habitat biodiversity. They are responsible for a large part of the complex interconnections that characterize natural ecosystems. The butterfly communities that are present in forests help to maintain crucial ecological processes and preserve biodiversity as a whole. They participate in most of the ecological processes that sustain ecosystems. A total of 56 species of butterflies under 7 families and 32genera were observed and recorded. Pieridae (15) and Nymphalidae (14) were recorded as the most dominant families in terms of number of species,

followed by Papilionidae (8) Lycaenidae (7) Danaidae (5) Hesperiidae (6) and Acraeidae (1) collected during the study period.

**Table 3-22 Occurrence of butterfly species in buffer zone**

| S.No | Scientific Name | Common Name |
|---|---|---|
| **Family Papilionidae** | | |
| 1. | PachlioptaaristolochiaeFabricius | The Common Rose |
| 2. | Pachliopta hector Linnaeus | The Crimson Rose |
| 3. | Papiliodemoleus Linnaeus | The Lime Butterfly |
| 4. | Papiliopolytes Linnaeus | The Common Mormon |
| 5. | Graphiumdoson Felder | The Common Jay |
| 6. | Graphiumagamemnon Linnaeus | The Tailed Jay |
| 7. | Pathysacrino Cramer | The common banded peacock |
| 8. | Papiliopolymnestor Cramer | The Blue Mormon |
| **Family Pieridae** | | |
| 9. | Hebononiaglaucippe Linnaeus | The Great Orange Tip |
| 10. | Delias eucharis Dury | The Common Jezebel |
| 11. | LeptosianinaFabricius, | The Psyche |
| 12. | CeporanerissaFabricius | The Common Gull |
| 13. | Appiasalbina Felder & Felder | The Common Albatross |
| 14. | Euremabrigitta rubella Wallace | The Small Grass Yellow |
| 15. | Euremahecabesimulata Moore | The Common Grass Yellow |
| 16. | CatopsiliapyrantheLinnaeus | The Mottled Emigrant |
| 17. | CatopsiliapomonaFabricius | The Lemon Emigrant |
| 18. | CatopiliaflorellaFabricius | The Common Vagrant |
| 19. | ColotisetridaBoisduval | The Little Orange Tip |
| 20. | Pareroniaceylonica Felder | The Dark Wanderer |
| 21. | Ixias Marianne Cramer | The White Orange Tip |
| 22. | Ixis pyrene Linnaeus | The Orange Tip |
| 23. | Colotis eucharis | The Plain Orange Tip |
| **Family Lycaenidae** | | |
| 24. | CastaliusrosimonrosimonFabricius | The Common Pierrot |
| 25. | SyntarucuspliniusFabricius | Zebra Blue |
| 26. | Chiladeslaius Cramer | The Lime Blue |
| 27. | ChiladesparrhasiusFabricius | The Small Cupid |
| 28. | Chiladespandavapandava Horsfield | The Plains Cupid |
| 29. | SpindasisvulcanusFabricius | The Common Silver Line |
| 30. | RathindaamorFabricius | The Monkey Puzzle |
| **Family Nymphalidae** | | |
| 31. | Ariadne ariadne indica Moore | The Angled Castor |
| 32. | Ariadne merionemerione Cramer | The Common Castor |
| 33. | JunoniaiphitapluvialisFruhstorfer | The Chocolate Pansy |
| 34. | Junoniaorithyaswinhoei Butler | The Blue Pansy |
| 35. | Junonialemonias Linnaeus | The Lemon Pansy |
| 36. | Hypolimnasmisippus Linnaeus | The Common or Danaid Eggfly |
| 37. | Hyplolimnasbolinajacintha Drury | The Great Eggfly |
| 38. | Neptishylasvarmona Moore | The Common Sailor |
| 39. | Neptisjumbahjumbah Moore | The Chestnut Streaked) Sailor |
| 40. | Phalantaphalantha Drury | The Leopard Butterfly |
| 41. | Melanitisledaleda Drury | The Common Evening Brown |
| 42. | Melanitisphedimavaraha Moore | The Dark Evening Brown |
| 43. | Orostrionamedusmandata Moore | The Nigger |

| | | |
|---|---|---|
| 44. | Euthialianais Forster | Baronet |
| **Family Danaidae** | | |
| 45. | Danaus chrysippuschrysippus Linnaeus | The Plain Tiger |
| 46. | Tirumala limniaceexoticusGmelin | The Blue Tiger |
| 47. | Euploea core core Cramer | The Common Crow |
| 48. | EuploeasylvestercoretaGodart | The Double Branded Crow |
| 49. | Danaus.genutiagenutia Cramer | Common tigers |
| 50. | Family Acraeidae | |
| 51. | Acraea terpsicore Linnaeus | The Tawny Coster |
| **Family Hesperidae** | | |
| 52. | Borbobevanibevani Moore | The Bevan's Swift |
| 53. | SuastusgremiusgremiusFabricius | The Indian palm bob |
| 54. | Pelopidas mathiasmathiasFabricus | The Small branded swift |
| 55. | Caltoriscanara Moore | The Kanara Swift |
| 56. | BorbocinnaraWallengren | The Rice Swift |
| 57. | Iambrixsalsalalutipennis Evans | Cestnut bob |

Livestock like cattle, buffalo, goat, poultry, duck and pig are reared for dairy products, meat, egg and for agriculture purpose. Majority of cattle and buffalo are of local variety. Backyard poultry farms are mostly common in this area.

### 3.11.10 Aquatic Ecology

**Introduction**

The study area intersected with few natural drainages and lake. A number of samples were investigated for enumeration of aquatic fauna. In order to study aquatic flora and faunal lifeone-time survey was conducted during the post-monsoon season. Major component of the aquatic life under the study area are listed below.

**Phytoplankton and Zooplankton**

The aquatic ecological study was conducted in and surrounding lake were 10 water samples from collected sub surface level.

**Significance of Plankton**

Planktons can be broadly grouped in to two categories those with plant origin are called 'Phytoplankton' and those with animal origin are called 'Zooplankton'.

**Phytoplankton**

Phyto plankton samples were collected without filtering the water. To preserve, 0.3m Llugol's solution was added to100ml sample. Subsequently phytoplankton were concentrated by centrifugation and analysed microscopically in laboratory. Identification of phytoplankton was done using standard taxonomickeys. The Lackey Drop (micro transect) method (Lackey1938) is as imple method for obtaining counts of considerable accuracy (APHA2012). 9 species were recorded from the study area. A total of 6 species were recorded.

**Table 3-23 List of Phytoplankton**

| S. No | Phytoplankton |
|---|---|
| 1. | *Oscillatoria subbrevis* |
| 2. | *Pediastrum duplex* |
| 3. | *Spirogyra sp.* |
| 4. | *Navicularhynchocephala* |
| 5. | *Microcystis aeruginosa* |
| 6. | *Anabena sp.* |
| 7. | *Nitzschia sp.* |
| 8. | *Flagilaria sp.* |
| 9. | *Cyclotella sp.* |

**Zooplankton**

Sample collection was carried out in the similar method as that of phytoplankton. Three major groups of zooplankton, namely, Cladocera, Copepoda, Rotifera, were found. A total 14 species were observed. Literature revealed that the serotifers were commonly found in the mesotrophic and oligotrophic waters and are significant component of zooplankton.

**Table 3-24 List of Zooplankton**

| S. No | Species |
|---|---|
| **Rotifera** | |
| 1. | *Assulinamuscorum* |
| 2. | *Brachionusfalcatus* |
| 3. | *Brachionuscalyciflorus* |
| 4. | *Brachionus angularis* |
| 5. | *Lecanecurvicornis* |
| 6. | *Polyarthra vulgaris* |
| 7. | *Filinialongiseta* |
| **Copepoda** | |
| 8. | *Mesocyclopshyalinus* |
| 9. | *Mesocyclopshyalinus* |
| 10. | *Cyclopoid copepodite* |
| 11. | *Cyclopoid nauplii* |
| **Cladocera** | |
| 12. | *Chydorussphaericus* |
| **Ostracoda** | |
| 13. | *Cypris subglobosa* |
| **Miscellaneous - Aquatic insects** | |
| 14. | *Mosquito larvae* |

### 3.11.11 Impact and Management Plan for Biological Environment

The proposed plant is located at near Pudukkudiyanur is a populated place which is located in nearby to Kodakkal Area. The proposed project will not have any impact of terrestrial and aquatic ecology of the area. Therefore, in and around area were one reserve forest and natural area. In addition to that,

Industrial area decided to develop the greenbelt by planting native species to maintain the good environment.

**Impact on Wildlife**

There is no National Park, Wildlife Sanctuary, Biosphere Reserve, Wildlife corridors and Tiger/Elephant Reserve found within 10 km radius of the project site.

**Impact on Flora**

Plantation will be developed in the development area as per plantation programme. These activities will help to improve the floral cover of the area. The greenery and plantation development will eventually attract micro fauna, birds etc in the area. Assistance will be taken from local forest department in selection of species of plants so that green coverage may improve fast. The varieties would include those plants, which are suitable to the area. The following plant species will be planted according to CPCB guidelines: *Cassia fistula, Delbergiasisso, Mangifera indica, Acacia nilotica, Azadirachta indica, Albizza lebbek, Delonix regia, Ficus benghalensis, Butea monosperma,* etc.

❖ **Greenbelt development**

The main objective of green belt development is to provide a barrier between the source of pollution and the surrounding area. Green belt development around the various project appurtenances is proposed, this will go a long way to protect environment and mitigate pollution levels in the area. Development of green belt shall also prevent soil erosion and washing away of the topsoil besides helping in stabilizing the functional ecosystem, make the climate more conductive and restore water balance.

❖ **Plantation work**

A 20-25m wide green belt shall be proposed in the avenue plantation will be undertaken besides the project area and near village. Plantation comprising of medium height trees (7 m to 10 m) are proposed for the green belt. Selection of species for green belt Development of the green belt is one of the most sensitive issues and shall be done with due care. Selection of proper locally grown species in addition to checking of their growth rate, quality, thickness of canopy cover, etc. shall be duly done as it helps in abatement of fugitive noise, reduce the pollution level, thus making the place worth dwelling for the diversified species flora. The plant species suitable for green belt development need to be selected based on the flowing criteria.

- Native plant species will be preferred
- Fast growing plants will be planted
- Plants having thick canopy cover will be used
- Preferably perennial and evergreen species will be selected
- Plants having large leaf area index will be considered
- Road sides will be planted with local vegetation

While making choice of plant species for cultivation in green belts, weightage has to be given to the natural factor of bio-climate. It is also presumed that the selected plants will be grown as per normal horticultural or forestry practices. Trees are important sinks for air pollutants. Trees absorb noise and by enhancing the green cover, improve the ecology and aesthetics and affect the local micrometeorology. Trees also have major long-term impacts on soil quality and the ground water table. By using suitable plant species, green belts can be developed in strategic zones to provide protection from emitted and noise. The suitable variety/species shall be finalized in consultation with local forest officer and horticultural experts. Mixed plantation shall be done keeping optimum spacing between the saplings.

**Table 3-25 Selected list of plant species for Greenbelt development**

| S.No | BINOMIAL | FAMILY | COMMON NAME | HABIT |
|---|---|---|---|---|
| 1. | *Acacia nilotica* | Mimosaceae | Karuvelam | Tree |
| 2. | *Acacia planifrons* | Mimosaceae | Kodaivelam, Udaimaram | Tree |
| 3. | *Bauhinia purpurea* | Caesalpiniaceae | Mantharai | Tree |
| 4. | *Delonix regia* | Caesalpiniaceae | MayilKondrai | Tree |
| 5. | *Ficus benghalensis* | Moraceae | Aal, Ichi, per-al | Tree |
| 6. | *Ficus religiosa* | Moraceae | Arasu | Tree |
| 7. | *Melia azedarach* | Meliaceae | Malaivaembu | Tree |
| 8. | *Phyllanthus emblica* | Euphorbiaceae | Nelli, Muzhunelli | Tree |
| 9. | *Pithecellobium dulce* | Mimosaceae | Kodukkaaipuli | Tree |
| 10. | *Pongamia pinnata* | Fabaceae | Punga maram | Tree |
| 11. | *Psidium guajava* | Myrtaceae | Koyya | Tree |
| 12. | *Syzygiumcumini* | Myrtaceae | Navaal, Nava | Tree |
| 13. | *Tamarindus indica* | Caesalpiniaceae | Puliyamaram | Tree |
| 14. | *Tectona grandis* | Verbenaceae | Thekku | Tree |
| 15. | *Terminalia catappa* | Combretaceae | Natvadumai, NaattuBadaam | Tree |
| 16. | *Wrightia tinctoria* | Apocynaceae | Nilapaalai, Vetpaalai | Tree |
| 17. | *Ziziphus mauritiana* | Rhamnaceae | Illandhai | Tree |

**Impact on Fauna**

The plant unit area is in non-forest land where presence of fauna is very rare. As such, there will be no adverse impact of the plant unit activity on fauna around the plant unit area.A comprehensive Central Legislation Namely Wild Life (Protection) Act was enforced in 1972 to provide protection to wild animals. Schedule-I of this act contains the list of rare and endangered species, which are completely protected throughout the country. The list of wild animals and their conservation status as per Wild Life Act (1972) are presented in Table-3.21 species recorded/reported from study area, there are no endangered, threatened wild animal species in study area.

**Impact on Aquatic Ecology**

There are several lakes present within 10 km radius of the project site but no impact envisaged on aquatic ecology from the operation of facilities in construction or operational phases as there is water

body within plant site boundary.

The following are the suggestions for the management of the in and around water body.

- Growing of floating hydrophytes and systematic removal in invasive species.
- Community awareness on pond water resources, conservation and management should be enhanced.
- Mass awareness programs should be need.
- The conservation of wetlands should aim to support the implementation activities such as cleaning campaigns, removal of construction debris, development of recreational areas, water retention structures and planting of trees in the site.

Proper awareness programmes for the protection of wetlands must be undertaken, following slogan may be used for mass awareness. "Wetlands are Kidney of Nature- Protect them".*)*

## 3.12 Socio Economic profile of Project Influenced Area

As per the 2011 Census, Vellore district consists of 3 Revenue Divisions viz., Vellore (Taluks include Vellore, Katpadi, Gudiyatham), Ranipet (Taluks include Walajah, Arakonam, Arcot), and Tirupathur (Taluks include Thirupathur, Vaniyambadi, Ambur). This district has 9 Taluks, 20 Community Development Blocks, 52 Firkas, 1 Municipal Corporation, 13 Municipalities, 22 Town Panchayats and 36 Census Towns. Vellore district is situated in the northern part of Tamil Nadu bordering Andra Pradesh. The district bounded by Andra Pradesh on the north, Thiruvallur district on the northeast, Kancheepuram district on the east, Tiruvannamalai district on the south and Krishnagiri district on the West. The total geographical area of the district is 6075 sq. kms. In terms of size, Vellore district ranked 4th in comparision to other district in the State.

Vellore district ranked 3rd place in terms of the highest population in the State. The district has recorded population density of 648persons/sq.km. The urban population in the district was 43.2% to the total population. The decadal population growth of the district during 2001-2011 was 13.2%. The district sex ratio was 1007, higher than the State sex ratio of 996. The district has recorded the 3rd highest Scheduled Caste sex ratio of 1026 among the districts. The district has recorded the literacy of 79.2%.

***Source:***https://censusindia.gov.in/2011census/dchb/DCHB_A/33/3304_PART_A_DCHB_VELLORE.pdf

*(**Ref:** Directorate of Census Operations Tamil Nadu, "District Census Handbook 2011, Vellore District", Series-34, Part XII-A)*

***Note:*** *Ranipet district was a part of Vellore district before the bifurcation on 28th November 2019. Since secondary sources are available only for Vellore district, however Vellore district comprises Ranipet district details before bifurcation*.

### 3.12.1 Socio Economic Aspects

A socio-economic study was undertaken in assessing aspects which are dealing with social and cultural conditions, and economic status with secondary sources in the study area. The study provides information such as demographic structure, population dynamics, infrastructure resources, and the status of human health and economic attributes like employment, per-capita income, agriculture, trade, and industrial development in the study area. The study of these characteristic helps in identification, prediction and evaluation of impacts on socio-economic and parameters of human interest due to proposed project developments. The parameters are:

- Demographic structure
- Infrastructure Facility
- Economic Status
- Health status
- Cultural attributes
- Awareness and opinion of people about the project and Industries in the area.

The following **Table 3.26** provides the certain important social indicators of Vellore District.

**Table 3-26 Social Indicators of the PIA district**

| S.No | Social Indicators | Vellore District |
|---|---|---|
| 1. | Decadal variation % | 13.2 |
| 2. | Urban population % | 43.24 |
| 3. | Rural Population % | 56.76 |
| 4. | Sex ratio | 1007 |
| 5. | 0-6 age Child sex ratio | 944 |
| 6. | Population density (Persons per square Km) | 648 |
| 7. | Scheduled caste population % | 21.85 |
| 8. | Scheduled tribe population % | 1.85 |
| 9. | Literacy rate % | 79.17 |
| 10. | Work Participation rate % | 37.5 |
| 11. | Main Workers % | 80.52 |
| 12. | Marginal Workers % | 19.48 |
| 13. | Cultivators % | 10.37 |
| 14. | Agricultural labourers % | 23.2 |
| 15. | Workers in household industries % | 8.08 |
| 16. | Other workers % | 58.36 |

***Source:***

https://censusindia.gov.in/2011census/dchb/DCHB_A/33/3304_PART_A_DCHB_VELLORE.pdf

(***Ref:*** *Directorate of Census Operations Tamil Nadu, "District Census Handbook 2011, Vellore District", Series-34, Part XII-A)*

***Note:*** *Ranipet district was a part of Vellore district before the bifurcation on 28th November 2019. Since secondary sources are available only for Vellore district, however Vellore district comprises Ranipet district details before bifurcation.*

### 3.12.2 Population and Household Size

In 2011 census, the total population of Vellore district was 3936331. Of this, rural population was 2234344 and urban population was 1701987. In 2001, they were 3477317, 2169319 and 1307998 respectively.Arakonam taluk has the highest number of inhabited villages (133) while Vaniyambadi taluk has the lowest number (48) of such villages. Madapalli village in Tirupathur taluk had the highest population of 14,868 and Madakadappa R.F. village in Vaniyambadi taluk recorded the lowest population of 14 in the district. Ambur Reserve Forest Village in Ambur taluk is the largest village with an area of 10656.09 hectares and Ambur Plantation Reserve Forest in Ambur taluk is the smallest village with an area of 2.47 hectares. The district has recorded the 3rd highest percentage of household industry workers to total workers of 8.1% among the districts.

***Source:***

https://censusindia.gov.in/2011census/dchb/DCHB_A/33/3304_PART_A_DCHB_VELLORE.pdf

(***Ref:*** *Directorate of Census Operations Tamil Nadu, "District Census Handbook 2011, Vellore District", Series-34, Part XII-A)*

***Note:*** *Ranipet district was a part of Vellore district before the bifurcation on 28th November 2019. Since secondary sources are available only for Vellore district, however Vellore district comprises Ranipet district details before bifurcation.*

### 3.12.3 Sex Ratio

The sex ratio is defined as number of females to 1000males. The total sex ratio in the district as per 2011 census was 1007. This was recorded as 997 in 2001 census. The child sex ratio in the district during 2011 census was 944 and this was 943 in 2001 census.

***Source:***

https://censusindia.gov.in/2011census/dchb/DCHB_A/33/3304_PART_A_DCHB_VELLORE.pdf

(***Ref:*** *Directorate of Census Operations Tamil Nadu, "District Census Handbook 2011, Vellore District", Series-34, Part XII-A)*

***Note:*** *Ranipet district was a part of Vellore district before the bifurcation on 28th November 2019. Since secondary sources are available only for Vellore district, however Vellore district comprises Ranipet district details before bifurcation.*

### 3.12.4 Scheduled Castes and Scheduled Tribes

The Scheduled Castes (SCs) population in Vellore district was 20.5% in 2001 census which has increased to 21.9% in 2011 census. The rural-urban composition of SCs was 24.5% and 18.4% respectively in 2011 census. The Scheduled Tribes (STs) population in the district was 1.8% in 2001 census and returned with a marginal increase to 1.9% in 2011 census. The rural-urban composition of STs in 2011 census was 2.9% and 0.5% respectively.

***Source:***

https://censusindia.gov.in/2011census/dchb/DCHB_A/33/3304_PART_A_DCHB_VELLORE.pdf

(***Ref:*** *Directorate of Census Operations Tamil Nadu, "District Census Handbook 2011, Vellore District", Series-34, Part XII-A)*

***Note:*** *Ranipet district was a part of Vellore district before the bifurcation on 28th November 2019. Since secondary sources are available only for Vellore district, however Vellore district comprises Ranipet district details before bifurcation.*

### 3.12.5 Education & Literacy

In Census, a person aged 7 and above is consideredliterate, if he or she can read and write with understandingin any language.The literacy rate in the Vellore district has increased in 2011census compared to 2001 census.The rural and urban literacy in the district has recorded significant disparity. The rural literacy was 67.4% in 2001 which has marginally increased to 7.3% in 2011 with 74.7% while the urban literacy in the district was 80.5% in 2001. The urban literacy in the district has seen significant increase in 2011 census compared to 2001 census. In 2011 census, Vellore district has returned 79.2% as literate population; males with 86.5% and females with 71.9%.The total literacy in 2001 was 72.4%; males with 82.4% and females at 62.8%.

***Source:***

https://censusindia.gov.in/2011census/dchb/DCHB_A/33/3304_PART_A_DCHB_VELLORE.pdf

(***Ref:*** *Directorate of Census Operations Tamil Nadu, "District Census Handbook 2011, Vellore District", Series-34, Part XII-A)*

***Note:*** *Ranipet district was a part of Vellore district before the bifurcation on 28th November 2019. Since secondary sources are available only for Vellore district, however Vellore district comprises Ranipet district details before bifurcation.*

**Table 3-27 Education Infrastructures in the Vellore District**

| Type of school | Total schools | | Rural Schools | |
|---|---|---|---|---|
| | Government | Private | Government | Private |
| Primary | 1439 | 660 | 1307 | 401 |
| Primary + Upper Primary | 460 | 84 | 410 | 44 |
| P + UP+ Secondary + Higher Secondary | 13 | 122 | 8 | 68 |
| UP only | 0 | 1 | 0 | 1 |
| UP + Secondary + Higher Secondary | 175 | 53 | 138 | 11 |
| P + UP + Secondary | 13 | 79 | 11 | 55 |
| UP + Secondary | 174 | 25 | 166 | 15 |

(***Source:*** *District Information Systems on Education (DISE report card 2016-17))*

### 3.12.6 Health Facilities

Primary Health Centres (PHCs) and Health Sub-centres (HSCs) are providing the preventive, curative and rehabilitative health care services to the rural people. The district has good number of public health systems accessible and affordable apart from the private health facilities. The Health Facilities given in below table**.**

**Table 3-28 Medical Facilities available in Vellore District**

| | | Facilities As on November 19, 2020 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Total Facility | | | | | Active Facilities | | | | |
| Name of the District | Type of Facility | Total [(A+ | Public [A] | Private [B] | Urban [C] | Rural [D] | Total [(A+ | Public [A] | Private [B] | Urban [C] | Rural [D] |

| | | B) or (C+ D)] | | | | | B) or (C+ D)] | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Vellore District** | SC | 455 | 455 | 0 | 0 | 455 | 454 | 454 | 0 | 0 | 454 |
| | PHC | 104 | 104 | 0 | 22 | 82 | 100 | 100 | 0 | 22 | 78 |
| | CHC | 21 | 20 | 1 | 1 | 20 | 21 | 20 | 1 | 1 | 20 |
| | SDH | 13 | 13 | 0 | 11 | 2 | 13 | 13 | 0 | 11 | 2 |
| | DH | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 1 |
| | Total | 594 | 593 | 1 | 34 | 560 | 589 | 588 | 1 | 34 | 555 |

*(**Source:** National Health Mission, as on November 19, 2020)*

*(**Note:** SC – Sub Center; PHC – Primary Health Center; CHC – Community Health Center; SDH – Sub District Hospital; DH – District Hospital)*

### 3.12.7 Social Economic Profile of the study area

The villages and towns covering 10 km radius from the boundary of the project site is taken for the study. **Table 3-29** shows the population profile within the study area.

**Table 3.29 Population profile within the study area**

| S. No | Name | Households | Total Population | Male | Female | Children below 6 | Scheduled Caste | Scheduled Tribe |
|---|---|---|---|---|---|---|---|---|
| **0-5km** | | | | | | | | |
| **Walajah Taluk - Vellore District** | | | | | | | | |
| 1. | Thengal | 371 | 1480 | 714 | 766 | 156 | 369 | 34 |
| 2. | Kilminnal | 1908 | 8004 | 3955 | 4049 | 818 | 1562 | 32 |
| 3. | Nandiyalam | 2121 | 8984 | 4433 | 4551 | 1079 | 1477 | 8 |
| **Vaniyambadi Taluk - Vellore District** | | | | | | | | |
| 4. | Nimmiyambattu | 1478 | 6589 | 3350 | 3239 | 703 | 721 | 2 |
| **5 - 10km** | | | | | | | | |
| **Walajah Taluk - Vellore District** | | | | | | | | |
| 5. | Sikarajapuram | 1442 | 5541 | 2766 | 2775 | 522 | 1174 | 29 |
| 6. | Maniyambattu | 1264 | 5258 | 2608 | 2650 | 612 | 1895 | 3 |
| 7. | Melvisharam (M) | 8906 | 44786 | 22655 | 22131 | 5508 | 4025 | 15 |
| 8. | Melvisharam (M) WARD NO.-0001 | 342 | 1553 | 735 | 818 | 192 | 1478 | 0 |
| 9. | Melvisharam (M) WARD NO.-0002 | 501 | 2283 | 1114 | 1169 | 246 | 839 | 8 |
| 10. | Melvisharam (M) WARD NO.-0003 | 528 | 2983 | 1591 | 1392 | 290 | 1333 | 7 |
| 11. | Melvisharam (M) WARD NO.-0004 | 470 | 2010 | 1012 | 998 | 226 | 0 | 0 |
| 12. | Melvisharam (M) WARD NO.-0005 | 382 | 1634 | 785 | 849 | 190 | 9 | 0 |
| 13. | Melvisharam (M) WARD NO.-0006 | 560 | 2481 | 1246 | 1235 | 271 | 16 | 0 |
| 14. | Melvisharam (M) WARD NO.-0007 | 382 | 1943 | 946 | 997 | 245 | 0 | 0 |
| 15. | Melvisharam (M) WARD NO.-0008 | 324 | 1686 | 829 | 857 | 209 | 0 | 0 |

| S. No | Name | Households | Total Population | Male | Female | Children below 6 | Scheduled Caste | Scheduled Tribe |
|---|---|---|---|---|---|---|---|---|
| 16. | Melvisharam (M) WARD NO.-0009 | 316 | 1616 | 806 | 810 | 228 | 4 | 0 |
| 17. | Melvisharam (M) WARD NO.-0010 | 547 | 2782 | 1423 | 1359 | 352 | 333 | 0 |
| 18. | Melvisharam (M) WARD NO.-0011 | 519 | 2699 | 1353 | 1346 | 385 | 0 | 0 |
| 19. | Melvisharam (M) WARD NO.-0012 | 259 | 1347 | 672 | 675 | 221 | 0 | 0 |
| 20. | Melvisharam (M) WARD NO.-0013 | 466 | 2266 | 1090 | 1176 | 346 | 0 | 0 |
| 21. | Melvisharam (M) WARD NO.-0014 | 266 | 1426 | 721 | 705 | 193 | 0 | 0 |
| 22. | Melvisharam (M) WARD NO.-0015 | 480 | 2590 | 1296 | 1294 | 346 | 0 | 0 |
| 23. | Melvisharam (M) WARD NO.-0016 | 157 | 826 | 428 | 398 | 102 | 0 | 0 |
| 24. | Melvisharam (M) WARD NO.-0017 | 491 | 2453 | 1188 | 1265 | 295 | 0 | 0 |
| 25. | Melvisharam (M) WARD NO.-0018 | 804 | 4268 | 2101 | 2167 | 494 | 0 | 0 |
| 26. | Melvisharam (M) WARD NO.-0019 | 301 | 1414 | 729 | 685 | 163 | 0 | 0 |
| 27. | Melvisharam (M) WARD NO.-0020 | 304 | 1962 | 1262 | 700 | 174 | 13 | 0 |
| 28. | Melvisharam (M) WARD NO.-0021 | 507 | 2564 | 1328 | 1236 | 340 | 0 | 0 |
| 29. | Narasingapuram (CT) | 2869 | 11454 | 5753 | 5701 | 990 | 2437 | 70 |
| 30. | Narasingapuram (CT) WARD NO.-0001 | 2869 | 11454 | 5753 | 5701 | 990 | 2437 | 70 |
| 31. | Navlock Garden (CT) | 5023 | 20171 | 10087 | 10084 | 1960 | 3802 | 264 |
| 32. | Navlock Garden (CT) WARD NO.-0001 | 5023 | 20171 | 10087 | 10084 | 1960 | 3802 | 264 |

| S. No | Name | Households | Total Population | Male | Female | Children below 6 | Scheduled Caste | Scheduled Tribe |
|---|---|---|---|---|---|---|---|---|
| 33. | Nimmiyambattu | 1478 | 6589 | 3350 | 3239 | 703 | 721 | 2 |
| **Vaniyambadi Taluk - Vellore District** | | | | | | | | |
| 34. | Vellakuttai | 2013 | 8395 | 4262 | 4133 | 892 | 1194 | 0 |
| 35. | Alangayam (TP) | 4183 | 18327 | 9059 | 9268 | 2042 | 6028 | 397 |
| 36. | Alangayam (TP) WARD NO.-0001 | 204 | 796 | 386 | 410 | 100 | 6 | 112 |
| 37. | Alangayam (TP) WARD NO.-0002 | 211 | 868 | 426 | 442 | 57 | 0 | 88 |
| 38. | Alangayam (TP) WARD NO.-0003 | 274 | 1209 | 585 | 624 | 115 | 436 | 0 |
| 39. | Alangayam (TP) WARD NO.-0004 | 252 | 1098 | 531 | 567 | 111 | 0 | 0 |
| 40. | Alangayam (TP) WARD NO.-0005 | 186 | 760 | 385 | 375 | 77 | 192 | 15 |
| 41. | Alangayam (TP) WARD NO.-0006 | 300 | 1271 | 628 | 643 | 152 | 47 | 6 |
| 42. | Alangayam (TP) WARD NO.-0007 | 249 | 1039 | 527 | 512 | 98 | 545 | 4 |
| 43. | Alangayam (TP) WARD NO.-0008 | 367 | 1580 | 775 | 805 | 169 | 412 | 99 |
| 44. | Alangayam (TP) WARD NO.-0009 | 362 | 1528 | 736 | 792 | 175 | 203 | 48 |
| 45. | Alangayam (TP) WARD NO.-0010 | 363 | 1780 | 893 | 887 | 223 | 1778 | 0 |
| 46. | Alangayam (TP) WARD NO.-0011 | 260 | 1168 | 579 | 589 | 141 | 34 | 11 |
| 47. | Alangayam (TP) WARD NO.-0012 | 177 | 774 | 391 | 383 | 68 | 8 | 0 |
| 48. | Alangayam (TP) WARD NO.-0013 | 416 | 1759 | 868 | 891 | 187 | 462 | 13 |
| 49. | Alangayam (TP) WARD NO.-0014 | 128 | 710 | 335 | 375 | 92 | 0 | 0 |

| S. No | Name | Households | Total Population | Male | Female | Children below 6 | Scheduled Caste | Scheduled Tribe |
|---|---|---|---|---|---|---|---|---|
| 50. | Alangayam (TP) WARD NO.-0015 | 434 | 1987 | 1014 | 973 | 277 | 1905 | 1 |
| | **Total** | **54037** | **240316** | **120546** | **119770** | **26485** | **41697** | **1602** |

(***Source:*** *Census 2011)*

A walk-through survey was conducted by visiting rural place within the 10 km radius. While doing so, many interactions with various people like farmers, women, labours, teachers, health workers, etc. were conducted.

### 3.12.2.1Employment and Livelihood

Majority of population in the study area comes under other working categories.As agriculture cannot be a main sustenance for most of farmers, they have dual professions. Farming is mostly seasonal, they involve in other livelihood activities like business, non-agriculture labour, agriculture labour and other service sectors. Fragmentation of landholding leads to adopt to have additional occupation. Irrigation sources in the district are poor and the agriculture depends on seasonal rainfall. The district has recorded the 3rd highest percentage of household industry workers to total workers of 8.1% among the districts. The Vellore district is one of the most vital and vibrant districts in terms of industrial development in the State. It has a dominant presence in the leather and leather based industries. VelloreDistrict accounts for more than 37% of the county's export leather and leather related products such as finished leather, shoe uppers, shoes, garments, gloves and so on. The leather industry occupies a very important place in the industrial map of Vellore district. There are 1,226 leather units spread over in the district mainly in Ranipet, Ambur and Vaniyambadi. The district has many big and small industries. The silk weaving industries are located at Wallajah. Leather, sugar, ceramics, chemicals and other allied small scale industries are located in different taluks. SIDCO Industrial Estates is established at Katpadi, Ranipet, Mukundarayapuram, Vannivedu and Arakonam. Of these, 901 factories are employing about 28204 workers; 16429 males and 11775 females. There were 227 footware factories with 15974 employees in this district.

***Source:****https://censusindia.gov.in/2011census/dchb/DCHB_A/33/3304_PART_A_DCHB_VELLORE.pdf*

**Table 3.30 Summaries of Employment and Livelihood within the study area**

| S. No | Name | Total Workers | Main Workers | Marginal Workers | Agriculture Workers | | | | Household Industry Workers | | Other Workers | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Cultivators | | Agri. Labourers | | | | | |
| | | | | | Main | Marginal | Main | Marginal | Main | Marginal | Main | Marginal |
| **0-5km** | | | | | | | | | | | | |
| **Walajah Taluk - Vellore District** | | | | | | | | | | | | |
| **1.** | Thengal | 573 | 558 | 15 | 54 | 2 | 34 | 0 | 6 | 0 | 464 | 13 |
| **2.** | Kilminnal | 3250 | 2666 | 584 | 248 | 11 | 441 | 206 | 97 | 24 | 1880 | 343 |
| **3.** | Nandiyalam | 3907 | 3676 | 231 | 251 | 1 | 689 | 47 | 255 | 26 | 2481 | 157 |
| Vaniyambadi Taluk - Vellore District | | | | | | | | | | | | |
| **4.** | Nimmiyambattu | 3117 | 1774 | 1343 | 670 | 155 | 436 | 657 | 36 | 73 | 632 | 458 |
| **5 - 10km** | | | | | | | | | | | | |
| **Walajah Taluk - Vellore District** | | | | | | | | | | | | |
| **5.** | Sikarajapuram | 1942 | 1668 | 274 | 67 | 25 | 45 | 99 | 20 | 15 | 1536 | 135 |
| **6.** | Maniyambattu | 2094 | 1871 | 223 | 44 | 8 | 33 | 13 | 43 | 7 | 1751 | 195 |
| **7.** | Melvisharam (M) | 15753 | 14293 | 1460 | 50 | 16 | 114 | 37 | 3299 | 235 | 10830 | 1172 |
| **8.** | Melvisharam (M) WARD NO.-0001 | 520 | 481 | 39 | 0 | 2 | 1 | 0 | 47 | 2 | 433 | 35 |
| **9.** | Melvisharam (M) WARD NO.-0002 | 818 | 804 | 14 | 3 | 0 | 4 | 0 | 116 | 0 | 681 | 14 |
| **10.** | Melvisharam (M) WARD NO.-0003 | 907 | 678 | 229 | 1 | 0 | 13 | 1 | 101 | 39 | 563 | 189 |
| **11.** | Melvisharam (M) WARD NO.-0004 | 935 | 864 | 71 | 2 | 0 | 35 | 3 | 439 | 19 | 388 | 49 |
| **12.** | Melvisharam (M) WARD NO.-0005 | 753 | 706 | 47 | 17 | 0 | 25 | 10 | 293 | 13 | 371 | 24 |
| **13.** | Melvisharam (M) WARD NO.-0006 | 1091 | 985 | 106 | 12 | 4 | 17 | 18 | 397 | 56 | 559 | 28 |
| **14.** | Melvisharam (M) WARD NO.-0007 | 525 | 521 | 4 | 0 | 0 | 0 | 0 | 6 | 0 | 515 | 4 |
| **15.** | Melvisharam (M) WARD | 491 | 484 | 7 | 1 | 0 | 0 | 0 | 10 | 0 | 473 | 7 |

| S. No | Name | Total Workers | Main Workers | Marginal Workers | Agriculture Workers | | | | Household Industry Workers | | Other Workers | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Cultivators | | Agri. Labourers | | | | | |
| | | | | | Main | Marginal | Main | Marginal | Main | Marginal | Main | Marginal |
| | NO.-0008 | | | | | | | | | | | |
| **16.** | Melvisharam (M) WARD NO.-0009 | 499 | 490 | 9 | 0 | 0 | 1 | 0 | 55 | 1 | 434 | 8 |
| **17.** | Melvisharam (M) WARD NO.-0010 | 956 | 922 | 34 | 1 | 0 | 1 | 0 | 23 | 2 | 897 | 32 |
| **18.** | Melvisharam (M) WARD NO.-0011 | 949 | 926 | 23 | 0 | 0 | 6 | 0 | 220 | 7 | 700 | 16 |
| **19.** | Melvisharam (M) WARD NO.-0012 | 546 | 533 | 13 | 0 | 0 | 1 | 0 | 224 | 1 | 308 | 12 |
| **20.** | Melvisharam (M) WARD NO.-0013 | 949 | 918 | 31 | 2 | 1 | 1 | 0 | 237 | 6 | 678 | 24 |
| **21.** | Melvisharam (M) WARD NO.-0014 | 447 | 393 | 54 | 0 | 0 | 0 | 1 | 6 | 4 | 387 | 49 |
| **22.** | Melvisharam (M) WARD NO.-0015 | 712 | 672 | 40 | 0 | 5 | 0 | 0 | 2 | 1 | 670 | 34 |
| **23.** | Melvisharam (M) WARD NO.-0016 | 227 | 226 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 224 | 1 |
| **24.** | Melvisharam (M) WARD NO.-0017 | 678 | 567 | 111 | 0 | 0 | 0 | 0 | 19 | 25 | 548 | 86 |
| **25.** | Melvisharam (M) WARD NO.-0018 | 2191 | 1624 | 567 | 1 | 4 | 9 | 2 | 1021 | 56 | 593 | 505 |
| **26.** | Melvisharam (M) WARD NO.-0019 | 414 | 411 | 3 | 0 | 0 | 0 | 0 | 3 | 0 | 408 | 3 |
| **27.** | Melvisharam (M) WARD NO.-0020 | 425 | 391 | 34 | 0 | 0 | 0 | 2 | 14 | 3 | 377 | 29 |
| **28.** | Melvisharam (M) WARD NO.-0021 | 720 | 697 | 23 | 8 | 0 | 0 | 0 | 66 | 0 | 623 | 23 |
| **29.** | Narasingapuram (CT) | 4331 | 3986 | 345 | 87 | 4 | 177 | 113 | 29 | 18 | 3693 | 210 |
| **30.** | Narasingapuram (CT) | 4331 | 3986 | 345 | 87 | 4 | 177 | 113 | 29 | 18 | 3693 | 210 |

| S. No | Name | Total Workers | Main Workers | Marginal Workers | Agriculture Workers | | | | Household Industry Workers | | Other Workers | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Cultivators | | Agri. Labourers | | | | | |
| | | | | | Main | Marginal | Main | Marginal | Main | Marginal | Main | Marginal |
| | WARD NO.-0001 | | | | | | | | | | | |
| **31.** | Navlock Garden (CT) | 7686 | 6633 | 1053 | 35 | 10 | 90 | 34 | 82 | 29 | 6426 | 980 |
| **32.** | Navlock Garden (CT) WARD NO.-0001 | 7686 | 6633 | 1053 | 35 | 10 | 90 | 34 | 82 | 29 | 6426 | 980 |
| **33.** | Nimmiyambattu | 3117 | 1774 | 1343 | 670 | 155 | 436 | 657 | 36 | 73 | 632 | 458 |
| **Walajah Taluk - Vellore District** | | | | | | | | | | | | |
| **34.** | Vellakuttai | 4221 | 3711 | 510 | 1251 | 37 | 1378 | 76 | 175 | 29 | 907 | 368 |
| **35.** | Alangayam (TP) | 7434 | 5917 | 1517 | 578 | 48 | 1339 | 494 | 163 | 158 | 3837 | 817 |
| **36.** | Alangayam (TP) WARD NO.-0001 | 336 | 292 | 44 | 70 | 3 | 136 | 17 | 0 | 4 | 86 | 20 |
| **37.** | Alangayam (TP) WARD NO.-0002 | 389 | 155 | 234 | 49 | 21 | 6 | 101 | 3 | 14 | 97 | 98 |
| **38.** | Alangayam (TP) WARD NO.-0003 | 662 | 487 | 175 | 74 | 2 | 137 | 108 | 14 | 16 | 262 | 49 |
| **39.** | Alangayam (TP) WARD NO.-0004 | 334 | 332 | 2 | 61 | 0 | 57 | 0 | 24 | 0 | 190 | 2 |
| **40.** | Alangayam (TP) WARD NO.-0005 | 318 | 311 | 7 | 44 | 2 | 196 | 0 | 4 | 0 | 67 | 5 |
| **41.** | Alangayam (TP) WARD NO.-0006 | 571 | 334 | 237 | 95 | 4 | 127 | 33 | 4 | 61 | 108 | 139 |
| **42.** | Alangayam (TP) WARD NO.-0007 | 417 | 416 | 1 | 36 | 0 | 230 | 0 | 4 | 0 | 146 | 1 |
| **43.** | Alangayam (TP) WARD NO.-0008 | 645 | 459 | 186 | 44 | 5 | 47 | 115 | 25 | 5 | 343 | 61 |
| **44.** | Alangayam (TP) WARD NO.-0009 | 516 | 428 | 88 | 13 | 6 | 40 | 12 | 15 | 7 | 360 | 63 |
| **45.** | Alangayam (TP) WARD NO.-0010 | 739 | 652 | 87 | 22 | 1 | 124 | 60 | 3 | 0 | 503 | 26 |
| **46.** | Alangayam (TP) WARD NO.- | 381 | 339 | 42 | 16 | 0 | 0 | 0 | 20 | 0 | 303 | 42 |

| S. No | Name | Total Workers | Main Workers | Marginal Workers | Agriculture Workers | | | | Household Industry Workers | | Other Workers | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Cultivators | | Agri. Labourers | | | | | |
| | | | | | Main | Marginal | Main | Marginal | Main | Marginal | Main | Marginal |
| | 0011 | | | | | | | | | | | |
| **47.** | Alangayam (TP) WARD NO.-0012 | 377 | 94 | 283 | 1 | 0 | 0 | 8 | 2 | 20 | 91 | 255 |
| **48.** | Alangayam (TP) WARD NO.-0013 | 658 | 596 | 62 | 12 | 3 | 86 | 37 | 20 | 8 | 478 | 14 |
| **49.** | Alangayam (TP) WARD NO.-0014 | 231 | 191 | 40 | 10 | 1 | 2 | 0 | 5 | 16 | 174 | 23 |
| **50.** | Alangayam (TP) WARD NO.-0015 | 860 | 831 | 29 | 31 | 0 | 151 | 3 | 20 | 7 | 629 | 19 |
| | **Total** | **92629** | **79356** | **13273** | **4755** | **550** | **6932** | **3111** | **7814** | **1127** | **59855** | **8485** |

*(**Source:** Census 2011)*

### 3.12.2.2 Educational Infrastructure within study area

The district has good primary and secondary education infrastructure in urban and rural areas. The people around the study area have well connected to educational infrastructures.The following **Table 3-31** shows the literates population and the percentage within the study area

**Table 3.31 Literates population and the percentage within the study area**

| S. No | Name | Total Population | Literates Population Male | Literates Population Female | Literates Population | % Literates | Illiterates Population | % Illiterates |
|---|---|---|---|---|---|---|---|---|
| **0-5km** | | | | | | | | |
| **Walajah Taluk - Vellore District** | | | | | | | | |
| 1. | Thengal | 1480 | 1046 | 549 | 497 | 434 | 165 | 269 |
| 2. | Kilminnal | 8004 | 5986 | 3288 | 2698 | 2018 | 667 | 1351 |
| 3. | Nandiyalam | 8984 | 6066 | 3327 | 2739 | 2918 | 1106 | 1812 |
| **Vaniyambadi Taluk - Vellore District** | | | | | | | | |
| 4. | Nimmiyambattu | 6589 | 4146 | 2371 | 1775 | 2443 | 979 | 1464 |
| **5 - 10km** | | | | | | | | |
| **Walajah Taluk - Vellore District** | | | | | | | | |
| 5. | Sikarajapuram | 5541 | 4335 | 2309 | 2026 | 1206 | 457 | 749 |
| 6. | Maniyambattu | 5258 | 4199 | 2195 | 2004 | 1059 | 413 | 646 |
| 7. | Melvisharam (M) | 44786 | 32797 | 17709 | 15088 | 11989 | 4946 | 7043 |
| 8. | Melvisharam (M) WARD NO.-0001 | 1553 | 1238 | 608 | 630 | 315 | 127 | 188 |
| 9. | Melvisharam (M) WARD NO.-0002 | 2283 | 1651 | 863 | 788 | 632 | 251 | 381 |
| 10. | Melvisharam (M) WARD NO.-0003 | 2983 | 2269 | 1296 | 973 | 714 | 295 | 419 |
| 11. | Melvisharam (M) WARD NO.-0004 | 2010 | 1442 | 789 | 653 | 568 | 223 | 345 |
| 12. | Melvisharam (M) WARD NO.-0005 | 1634 | 1099 | 589 | 510 | 535 | 196 | 339 |
| 13. | Melvisharam (M) WARD NO.-0006 | 2481 | 1749 | 957 | 792 | 732 | 289 | 443 |
| 14. | Melvisharam (M) WARD NO.-0007 | 1943 | 1606 | 806 | 800 | 337 | 140 | 197 |
| 15. | Melvisharam (M) WARD NO.-0008 | 1686 | 1419 | 704 | 715 | 267 | 125 | 142 |
| 16. | Melvisharam (M) WARD NO.-0009 | 1616 | 995 | 549 | 446 | 621 | 257 | 364 |
| 17. | Melvisharam (M) WARD NO.-0010 | 2782 | 1982 | 1067 | 915 | 800 | 356 | 444 |
| 18. | Melvisharam (M) WARD NO.-0011 | 2699 | 1800 | 970 | 830 | 899 | 383 | 516 |
| 19. | Melvisharam (M) WARD NO.-0012 | 1347 | 712 | 400 | 312 | 635 | 272 | 363 |
| 20. | Melvisharam (M) WARD NO.-0013 | 2266 | 994 | 565 | 429 | 1272 | 525 | 747 |

| S. No | Name | Total Population | Literates Population Male | Literates Population Female | Literates Population | % Literates | Illiterates Population | % Illiterates |
|---|---|---|---|---|---|---|---|---|
| 21. | Melvisharam (M) WARD NO.-0014 | 1426 | 1079 | 572 | 507 | 347 | 149 | 198 |
| 22. | Melvisharam (M) WARD NO.-0015 | 2590 | 2084 | 1096 | 988 | 506 | 200 | 306 |
| 23. | Melvisharam (M) WARD NO.-0016 | 826 | 671 | 354 | 317 | 155 | 74 | 81 |
| 24. | Melvisharam (M) WARD NO.-0017 | 2453 | 1964 | 1019 | 945 | 489 | 169 | 320 |
| 25. | Melvisharam (M) WARD NO.-0018 | 4268 | 3326 | 1721 | 1605 | 942 | 380 | 562 |
| 26. | Melvisharam (M) WARD NO.-0019 | 1414 | 1114 | 613 | 501 | 300 | 116 | 184 |
| 27. | Melvisharam (M) WARD NO.-0020 | 1962 | 1668 | 1134 | 534 | 294 | 128 | 166 |
| 28. | Melvisharam (M) WARD NO.-0021 | 2564 | 1935 | 1037 | 898 | 629 | 291 | 338 |
| 29. | Narasingapuram (CT) | 11454 | 9053 | 4823 | 4230 | 2401 | 930 | 1471 |
| 30. | Narasingapuram (CT) WARD NO.-0001 | 11454 | 9053 | 4823 | 4230 | 2401 | 930 | 1471 |
| 31. | Navlock Garden (CT) | 20171 | 15775 | 8412 | 7363 | 4396 | 1675 | 2721 |
| 32. | Navlock Garden (CT) WARD NO.-0001 | 20171 | 15775 | 8412 | 7363 | 4396 | 1675 | 2721 |
| 33. | Nimmiyambattu | 6589 | 4146 | 2371 | 1775 | 2443 | 979 | 1464 |
| **Vaniyambadi Taluk - Vellore District** | | | | | | | | |
| 34. | Vellakuttai | 8395 | 5616 | 3186 | 2430 | 2779 | 1076 | 1703 |
| 35. | Alangayam (TP) | 18327 | 12640 | 6802 | 5838 | 5687 | 2257 | 3430 |
| 36. | Alangayam (TP) WARD NO.-0001 | 796 | 492 | 272 | 220 | 304 | 114 | 190 |
| 37. | Alangayam (TP) WARD NO.-0002 | 868 | 619 | 325 | 294 | 249 | 101 | 148 |
| 38. | Alangayam (TP) WARD NO.-0003 | 1209 | 725 | 384 | 341 | 484 | 201 | 283 |
| 39. | Alangayam (TP) WARD NO.-0004 | 1098 | 792 | 431 | 361 | 306 | 100 | 206 |
| 40. | Alangayam (TP) WARD NO.-0005 | 760 | 494 | 283 | 211 | 266 | 102 | 164 |
| 41. | Alangayam (TP) WARD NO.-0006 | 1271 | 898 | 493 | 405 | 373 | 135 | 238 |
| 42. | Alangayam (TP) WARD NO.-0007 | 1039 | 689 | 378 | 311 | 350 | 149 | 201 |

| S. No | Name | Total Population | Literates Population Male | Literates Population Female | Literates Population | % Literates | Illiterates Population | % Illiterates |
|---|---|---|---|---|---|---|---|---|
| 43. | Alangayam (TP) WARD NO.-0008 | 1580 | 1063 | 560 | 503 | 517 | 215 | 302 |
| 44. | Alangayam (TP) WARD NO.-0009 | 1528 | 1129 | 587 | 542 | 399 | 149 | 250 |
| 45. | Alangayam (TP) WARD NO.-0010 | 1780 | 1122 | 637 | 485 | 658 | 256 | 402 |
| 46. | Alangayam (TP) WARD NO.-0011 | 1168 | 887 | 461 | 426 | 281 | 118 | 163 |
| 47. | Alangayam (TP) WARD NO.-0012 | 774 | 652 | 348 | 304 | 122 | 43 | 79 |
| 48. | Alangayam (TP) WARD NO.-0013 | 1759 | 1314 | 689 | 625 | 445 | 179 | 266 |
| 49. | Alangayam (TP) WARD NO.-0014 | 710 | 562 | 279 | 283 | 148 | 56 | 92 |
| 50. | Alangayam (TP) WARD NO.-0015 | 1987 | 1202 | 675 | 527 | 785 | 339 | 446 |
| | **Total** | **240316** | **176070** | **95088** | **80982** | **64246** | **25458** | **38788** |

*(**Source**: Census 2011)*

### 3.12.2.3 Health facility within the study area

The majority of people visit nearby Hospitals/health services provided by the Government. The area has got good public health facilities at easily reachable distances. There were no major health issues reported in our survey. Even for any minor ailments they contact medical facilities immediately as it is very accessible to them. The local transport facilities and the communication facilities are the main reasons to get immediate medical attention. The incidents of institutional delivery are high due to awareness, education, economic development, proximity to health delivery system. The Infant mortality rate and the maternal mortality rate have significantly reduced. The health facilities within the study area are given in **Table 3-32.**

**Table 3.32 Health facility within the study area**

| S.No | Type | Numbers |
|---|---|---|
| 1 | Community health centre | 3 |
| 2 | Primary health centre | 10 |
| 3 | Primary health sub-centre | 77 |
| 4 | Maternity and Child Welfare Centre | 17 |
| 5 | TB hospital/Clinic | 10 |
| 6 | Hospital Allopathic | 4 |
| 7 | Hospital Alternative Medicine | 3 |
| 8 | Dispensary Health Centre | 10 |
| 9 | Veterinary hospital | 15 |
| 10 | Mobile health clinic | 1 |
| 11 | Family Welfare Centre | 10 |
| 12 | Non-Government Medical facilities Out Patient | 6 |

*(**Source:** Census 2011)*

### 3.12.2.4 Summary

The Socioeconomic profile of the study area shows that the majority of people in the study area work in non-agricultural sector, however in rural area majority of the people in the rural area depends on agricultural sector. They have good educational infrastructures and the people in the study area are well connected to the educational infrastructures. The average literacy rate of the study area is 67.0%. The people in the study area are well connected to Government primary health centres and Primary health sub-centres.

**Table 3.33 Summaries of Socio-economic indicators within the study area**

| S.No | Particulars | Study area | Unit |
|---|---|---|---|
| 1. | Number of villages in the Study Area | 51 | Nos. |
| 2. | Total Households | 54037 | Nos. |
| 3. | Total Population | 240316 | Persons |
| 4. | Children Population (<6 Years Old) | 26485 | Persons |
| 5. | SC Population | 41697 | Persons |
| 6. | ST Population | 1602 | Persons |
| 7. | Total Working Population | 92629 | Persons |
| 8. | Main Workers | 79356 | Persons |
| 9. | Marginal Workers | 13273 | Persons |
| 10. | Cultivators | 5305 | Persons |
| 11. | Agricultural labours | 10043 | Persons |
| 12. | Household Industries | 8941 | Persons |
| 13. | Other Workers | 68340 | Persons |
| 14. | Literates | 176070 | Persons |
| 15. | Illiterates | 64246 | Persons |

# 4 ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

The impacts due to mining operation and its mitigation measures adopted are detailed in this chapter. In general, the opencast mining operations cause environmental problems such as degradation of land, deteriorating air, water and soil quality, affecting the biological and socio-economic environment of the area, if adequate control measures are not taken to prevent/mitigate the adverse environmental impacts, these operations may cause irreversible damage to the eco-system.

The opencast mining operations involve development of benches, approach roads, haul roads, blasting, excavation and handling & transportation of materials. If adequate control measures are not taken to prevent/mitigate the adverse environmental impacts, these operations may cause environmental degradation and lead to irreversible damage to the ecosystem. Various environmental impacts, which have been identified due to the proposed project, are discussed in the following sections. The environmental parameters most commonly affected by mining activities are:

- Air quality including Climate
- Noise levels and ground vibrations
- Water resources and quality
- Land use Pattern
- Soil quality
- Flora and Fauna
- Socio-Economic conditions
- Occupational Health.

## 4.1 Land Environment

The mining operation is in operation since1988and extent of lease area is 46.07.0 Ha.is Land classifies as a Government poramboke land. The quarry lease was applied quarry lease vide G.O. (3D) No. 75, Industries (MME-1) dept dated 03.09.2007 for 20 years & the lease period is valid up to 16.09.2027. The land use pattern is given in **Table** 4-1**.**

### 4.1.1 Land Degradation

The impact on land pattern in the area has been and will be due to

- Land degradation due to disposal of large volume of waste materials.
- Creation of infrastructural facilities like office, rest shelter, first-aid centre and other service facilities.

- Exposure of topsoil to wind and water erosion.

**Table 4-1 Land Use Pattern of the quarry area**

| S. No | Description | Present area ( Ha) | Modified Revised Scheme of Mining-III Period in Ha | Area at the end of the quarry (Ha) | Percentage of Area (%) |
|---|---|---|---|---|---|
| 1. | Area under quarrying | 3.18.0 | 0.95.0 | 41.32.0 | 89.88 |
| 2. | Waste Dump | 1.58.5 | 0.90.5 | 2.20.0 | 4.77 |
| 3. | Infrastructure | 0.03.0 | - | 0.03.0 | 0.06 |
| 4. | Roads | 1.03.5 | - | 0.05.0 | 0.10 |
| 5. | Green belt | 2.48.5 | 0.06.5 | 2.39.0 (0.09.0 Ha above waste dump) | 5.18 |
| 6. | Unutilized | 37.75.5 | 36.33.5 | 0.08.0 | 0.17 |
| **Total** | | **46.07.0** | **37.75.5** | **46.07.0** | **100** |

### 4.1.2 Mitigation Measures

- Dust suppression on exposed areas using water tankers and automatic sprinkling systems
- Contour overburden dump to minimize erosion
- Plantation using native plant sapling.
- Compliance with mine decommissioning plan.
- Drainage control structures like garland drain to be made around OB dump area to avoid water flow during monsoon below the OB dump.
- Leveling, grading and drainage arrangement for top of OB dumps.
- Topsoil to be stored in small heaps (5m high) at appropriate moisture content with proper vegetation.
- Top soil shall be used in afforestation work, as early as possible.
- Top soil will be removed & stored on the inner boundary of the mining lease area. To improve its quality, soil stabilizers shall be mixed and leguminous plantation will be done over these stacks.
- After complete extraction of estimated reserves of black granite. The deeper working pits, after completion of Mining /Quarrying left as it is, which would serve as water ponds/ water reservoirs.
- The quarried pits after the end of the life of lease will be fenced to prevent inherent entry of public and cattle's.
- Management plan for topsoil utilization and conservation.
- Progressive year-wise green belt development inside and outside the lease area.

## 4.2 Air Environment

The main source of air pollution is from open cast mining activities is dust generation from excavation of granite, movement of vehicles for transportation of product to consumers, drilling, loading and unloading operation and wind erosion of dumps and also gaseous emission due to operation of diesel driven mining equipment. The sources of air emission are detailed below in**Table 4-2.**

**Table 4-2 - Sources of air pollution at quarry**

| S. No | Source of emission | Pollutant |
|---|---|---|
| 1. | Excavation of Granite | PM |
| 2. | Operation of diesel driven equipment | Gaseous emission |
| 3. | Transportation of product | PM |

Baseline data reveals that ambient air quality in the study area for the Parameters SPM, $SO_2$& NOx, are well within the permissible Limits as prescribed by the National Ambient Air Quality Standards (NAAQS) for Industrial Area, Residential, Rural & Other areas.

The major air pollution sources from the mining operations are DG sets, Mining activities like blasting, drilling, cutting etc., and transportation. The DG set are provided with stacks of adequate height so as to disperse the emanating flue gases containing suspended particulate matters, oxides of sulphur and nitrogen without affecting the ground level concentrations. The emissions mainly generated from the existing dimension stone quarry mining activities are DG sets, mining activities, and transportation.

### 4.2.1 Mitigation measures

- Use of dust aprons on drilling equipment and adopting wet drilling methods.
- Usage of Wire saw machine to reduce blasting and drilling.
- Delay blasting under unfavorable wind and atmospheric conditions

The production of blast fumes containing noxious gases will be reduced by the following methods:

- Use of adequate booster/primer
- Proper stemming of the blast hole.
- Drills fitted with dust collection system to be deployed or using wet drilling method.
- Development of greenbelt.

**Table 4-3 Fugitive dust control in mine**

| S. No | Activities | Best practices |
|---|---|---|
| 1 | Drilling | ➢ Drills should be provided with dust extractors (dry or wet system) |
| 2 | Blasting | ➢ Water spray before blasting<br>➢ Water spray on blasted material prior to transportation<br>➢ Use of controlled blasting technique |
| 3 | Transportationof | ➢ Covering of the trucks/dumpers to avoid spillage |

| | | |
|---|---|---|
| | mined material | ➢ Compacted haul road<br>➢ Speed control on vehicles<br>➢ Development of a green belt of suitable width on both sidesof road, which acts as wind break and traps fugitive dust |

**Table 4-4 Dust control measures in quarry**

| S. No | Operation or source | Control options |
|---|---|---|
| 1 | Drilling | ➢ Liquid injection (water or water plus a wetting agent)<br>➢ Capturing and venting emissions to a control device. |
| 2 | Blasting | ➢ Water spray before blasting<br>➢ Water spray on blasted material prior to transportation<br>➢ Use of controlled blasting technique |
| 3 | Loading | ➢ Water spray |
| 4 | Hauling (emissions from roads) | ➢ Water spray, treatment with surface agents, soil stabilization, paving, traffic control. |
| 5 | Windblown dust from roads | ➢ Oiling surface active agents, soil stabilization, paving, sweeping. |

**Meteorological Data**

The site specific meteorological data for three months from Mid of Jan 2023 to Mid of April 2023 was obtained from secondary sources and processed in AERMET to plot wind rose diagram (Fig 4.3.1). Other data included for AERMET were daily wind speed, wind direction, temperature, relative humidity, air pressure, precipitation, and solar radiation recorded during the period. AERMET reformats meteorological data so that it can be used as input for AERMOD model.

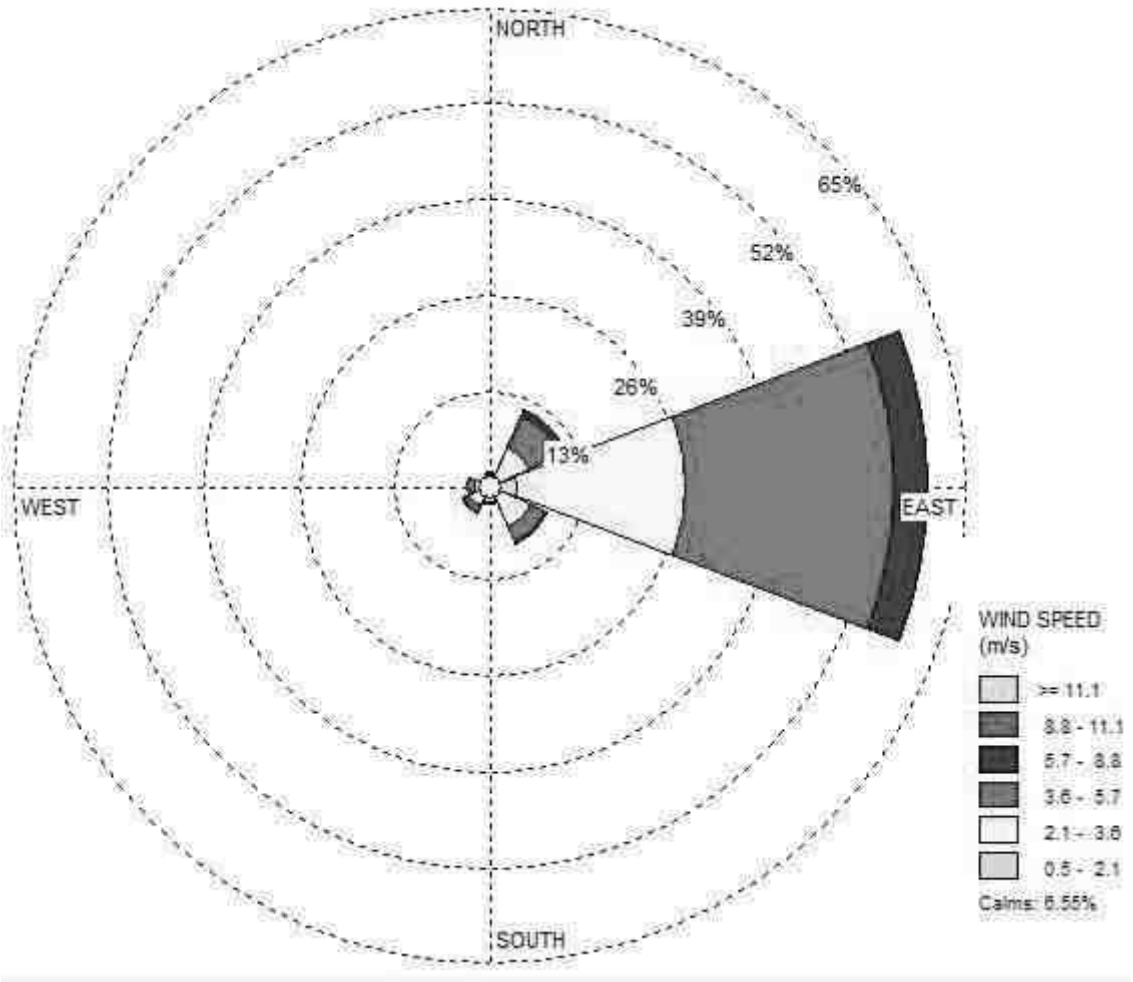


**Figure 4-1 Wind rose diagram considered for Dispersion Modeling (Jan mid.2023 to April mid.2023)**

**AERMET Process**

For the 3 phase AERMET processing of the meteorological data, specifications of the land use in the area are required to determine the terrain roughness for modeling. The land use was characterized for in and around the site. The surface characteristics for the site and surroundings were selected and used to calculate the Albedo, Bowen ratio and surface roughness parameter.

The meteorological data were processed in the AERMET software to generate wind flow pattern & to generate surface meteorological data and profile meteorological data in a prescribed format that can be fed to AERMOD for modeling.

**AERMOD Process**

AERMOD Software Version 8.0.5 was used for air dispersion modeling and is applicable to a wide range of buoyant or neutrally buoyant emissions up to a range of 50 km. In addition to more straight forward cases, AERMOD is also suitable for complex terrain and urban dispersion scenarios.

AERMOD is a steady-state plume model. In the stable boundary layer (SBL), it assumes the concentration distribution to be Gaussian in both the vertical and horizontal. In the convective

boundary layer (CBL), the horizontal distribution is also assumed to be Gaussian, but the vertical distribution is described with a bi-Gaussian probability density function (pdf). This behavior of the concentration distributions in the CBL was demonstrated by Willis and Deardorff (1981) and Briggs (1993). Additionally, in the CBL, AERMOD treats "plume lofting," whereby a portion of plume mass, released from a buoyant source, rises to and remains near the top of the boundary layer before becoming mixed into the CBL. AERMOD also tracks any plume mass that penetrates into the elevated stable layer, and then allows it to re-enter the boundary layer when and if appropriate. For sources in both the CBL and the SBL, AERMOD treats the enhancement of lateral dispersion resulting from plume meander. The emissions mainly generated from the mining activities are Blasting, Drilling, Scrapping, Excavation, Loading, Unloading, and transportation etc. Machinery like compressors and jack hammers are used for Drilling are estimated and used as inputs for the air dispersion modelling as shown in **Table 4-5** to **Table 4-9.**

Maximum incremental value for $SO_2$, NOx and PM are shown in **Figures 4-2** to **4-6** and Top 10 highest Ground Level Concentration (GLC) obtained from modeling are given in **Table 4-10 & 4-14** respectively.

**Emission Calculations**

Each mining activities is a source of emission and the estimation of emissions depends on parameters such as meteorological, topographic conditions and material characteristics. It is necessary to calculate the amount of emission for work or a source on site to the atmosphere. The following emission formulas are used to calculate the emission rate for the different emission source.

**Emission Factors Considered for emission estimation and Air Quality Modelling**

**Drilling**

Wet drilling = 8.00E-05 lbs $PM_{10}$/ton.

**Haul Roads**

$$E = [\{(100 - m)m^{-1}\}^{0.35} * \{(us)(100 - s)^{-1}\}]^{0.7}\{0.5 + 0.1(f + 0.42v)\}10^{-3} \quad (9)$$

Where E = emission rate (g/s)

m = moisture content (%)

s = silt content (%)

u = wind speed (m/s)

f = frequency of loading (no. $h^{-1}$)

v = average vehicle speed (m/s)

**Waste Dumping**

$$E = [\{(100-m)(m)^{-1}\}^{0.2}\{(s)(100-s)^{-1}\}^{0.1}\{(u)(2.6+120u)^{-1}\}\{(a)(0.2+276.5a)^{-1}\}] \quad (10)$$

Where E = emission rate (g/s)

m = moisture content (%)

s = silt content (%)

a = area ($km^2$)

**Open Pit**

$$E = [\{(100-m)(m)^{-1}\}^{0.1}\{s(100-s)^{-1}\}^{0.3}a^{1.6}\{(u)(10+125u)^{-1}\}] \quad (11)$$

Where E = emission rate ($g/s*m^2$)

s = silt content (%)

u = wind speed (m/s)

a = area ($km^2$)

m = moisture content (%)

**Source:**


1. Emission Estimation Technique Manual for Mining and Processing of Non-Metallic Minerals by NPI, Nov 1999
2. Determination of the emission rate from various opencast mining operations, S. K. CHAULYA∗, M. K. CHAKRABORTY, et. Al. *Water, Air, and Soil Pollution 140: 21–55, 2002.*
3. Chaulya, S., 2006. Emission rate formulae for surface iron mining activities. *Environmental Modeling Assessment,* Issue 11, pp. 361-370.
4. *EPA. August, 2004. Section 11.19.2, Crushed Stone Processing and Pulverized Mineral Processing. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.*


**Table 4-5 Overview of the Source Parameters**

| S. NO | Description | Symbol | Quantity |
|---|---|---|---|
| 1 | Moisture Content (%) | m | 1.64 |
| 2 | Silt Content (%) | s | 6 |
| 3 | Production / Day (Tonn/Day) | | 8 |
| 4 | Waste Dumping Area (Sq.Km) | a | 0.009 |
| 5 | Open Pit Area (Sq.Km) | Aa | 0.0133 |

**Table 4-6 Emission from Mining Equipments**

| Source | Fuel used | Stack Details | | | | | Emissions (g/s) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | No of Stack | Height (m) AGL | Dia (m) | Temp (°C) | Exit Velocity (m/s) | $PM_{10}$ | $PM_{2.5}$ | $SO_2$ | $NO_X$ |
| 125 KVA DG | Diesel | 1 | 3 | 0.3 | 180 | 10 | 5.81E-03 | 3.48E-03 | 5.38E-03 | 8.16E-02 |

**Table 4-7 Vehicular Sources Emission details**

| Source | Emission (g/s) | | |
|---|---|---|---|
| | $PM_{10}$ | $PM_{2.5}$ | $NO_X$ |
| 4 Wheeler (1 no.) | 6.94E-05 | 4.17E-05 | 6.94E-04 |
| Heavy Duty Vehicles (2 no.) | 1.11E-04 | 6.67E-05 | 1.94E-02 |
| **Total** | **1.81E-04** | **1.08E-04** | **2.01E-02** |

**Table 4-8 Emission Considered for Mining Activity**

| Activities | TSPM Emission rate | $PM_{10}$ Emission rate | $PM_{2.5}$ Emission rate |
|---|---|---|---|
| Wet Drilling (g/s) | 3.49E-06 | 6.98E-07 | 4.19E-07 |
| Haulage (g/s) | 1.02E-03 | 2.05E-04 | 1.23E-04 |
| Waste Dumping (g/s) | 4.77E-05 | 9.54E-06 | 5.72E-06 |
| Open Pit ($g/s.m^2$) | 5.11E-06 | 1.02E-06 | 6.14E-07 |

**Table 4-9 Emission input for modeling**

| Activities | TSPM | $PM_{10}$ | $PM_{2.5}$ | $SO_2$ | $NO_x$ |
|---|---|---|---|---|---|
| Line Source (Haul Road ) (g/s) | 1.02E-03 | 2.05E-04 | 1.23E-04 | - | - |
| Area Source (Open Pit) ($g/s.m^2$) | 5.11E-06 | 1.02E-06 | 6.14E-07 | - | - |
| Area Source (Waste Dumping) (g/s) | 4.77E-05 | 9.54E-06 | 5.72E-06 | - | - |
| Point Source (DG) (g/s) | - | 5.81E-03 | 3.48E-03 | 5.38E-03 | 8.16E-02 |
| Point Source (Drilling) (g/s) | 3.49E-06 | 6.98E-07 | 4.19E-07 | - | - |
| Line Source (Vehicle) (g/s) | - | 1.81E-04 | 1.08E-04 | - | 2.01E-02 |

**Note**:

a. Since emission factors are available for $PM_{10}$ the following assumptions are made for $PM_{10}$ and $PM_{2.5}$ estimation

1. TSPM is considered as 5 times of $PM_{10}$
2. 60% of $PM_{10}$ is considered as $PM_{2.5}$

b. Emission calculation is done for total production.

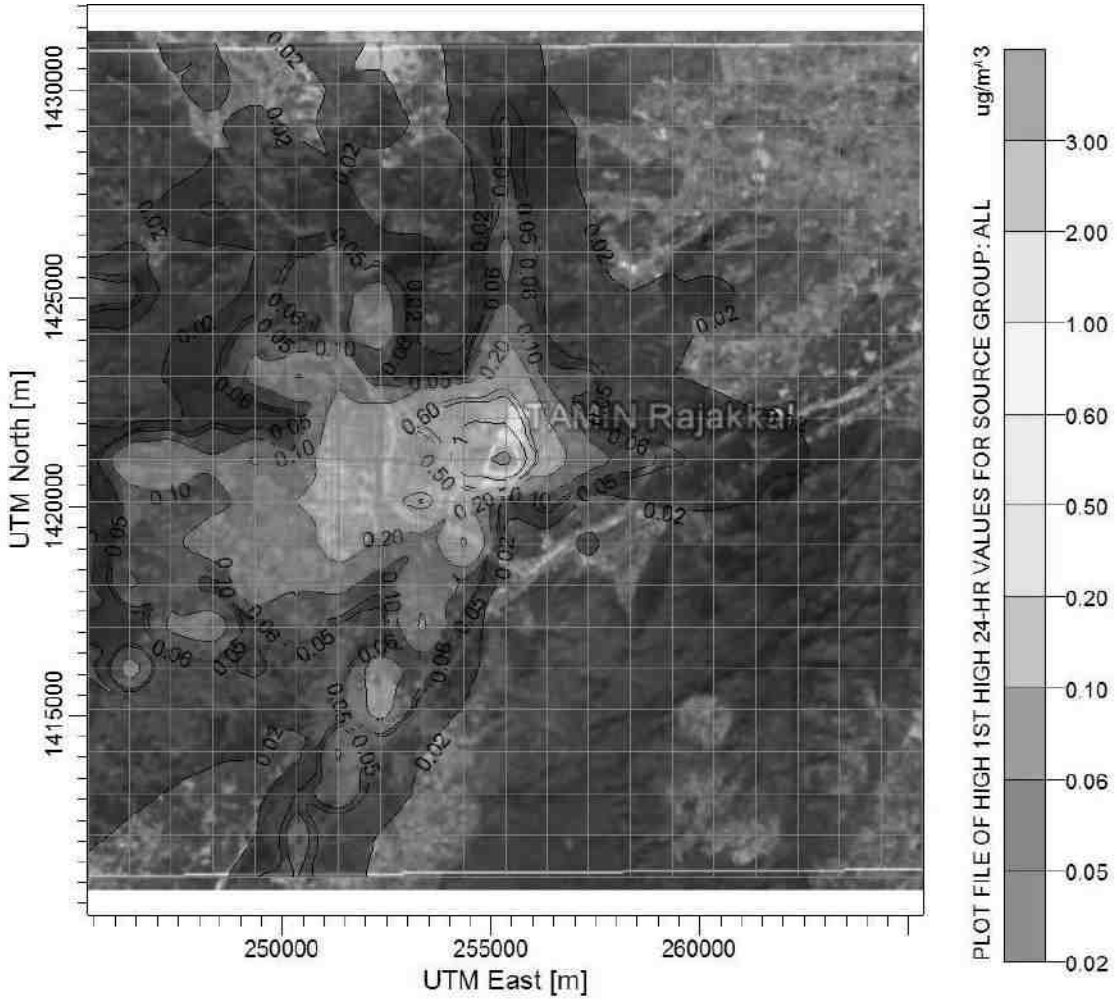


**Figure 4-2 Predicted 24 hrs GLC's of TSPM within 10 km radius of the Study area**

**Table 4-10 Predicted Top 10 Highest Concentration of TSPM**

| S.NO | UTM coordinates (m) | | Conc. (µg/m$^3$) | Distance from Centre of the project (km) | Direction from project Centre |
|---|---|---|---|---|---|
| | E | N | | | |
| 1. | 255340 | 1421136 | 2.34741 | Project Site | |
| 2. | 254340 | 1421136 | 1.53774 | 1 | W |
| 3. | 254340 | 1422136 | 0.98635 | 1.41 | NW |
| 4. | 255340 | 1422136 | 0.89784 | 1 | N |
| 5. | 253340 | 1422136 | 0.68735 | 2.24 | WNW |
| 6. | 253340 | 1420136 | 0.62552 | 2.24 | WSW |
| 7. | 254340 | 1419136 | 0.54944 | 2.24 | SSW |
| 8. | 255340 | 1423136 | 0.41396 | 2 | N |
| 9. | 252340 | 1420136 | 0.40781 | 3.16 | WSW |
| 10. | 252340 | 1421136 | 0.39051 | 3 | W |

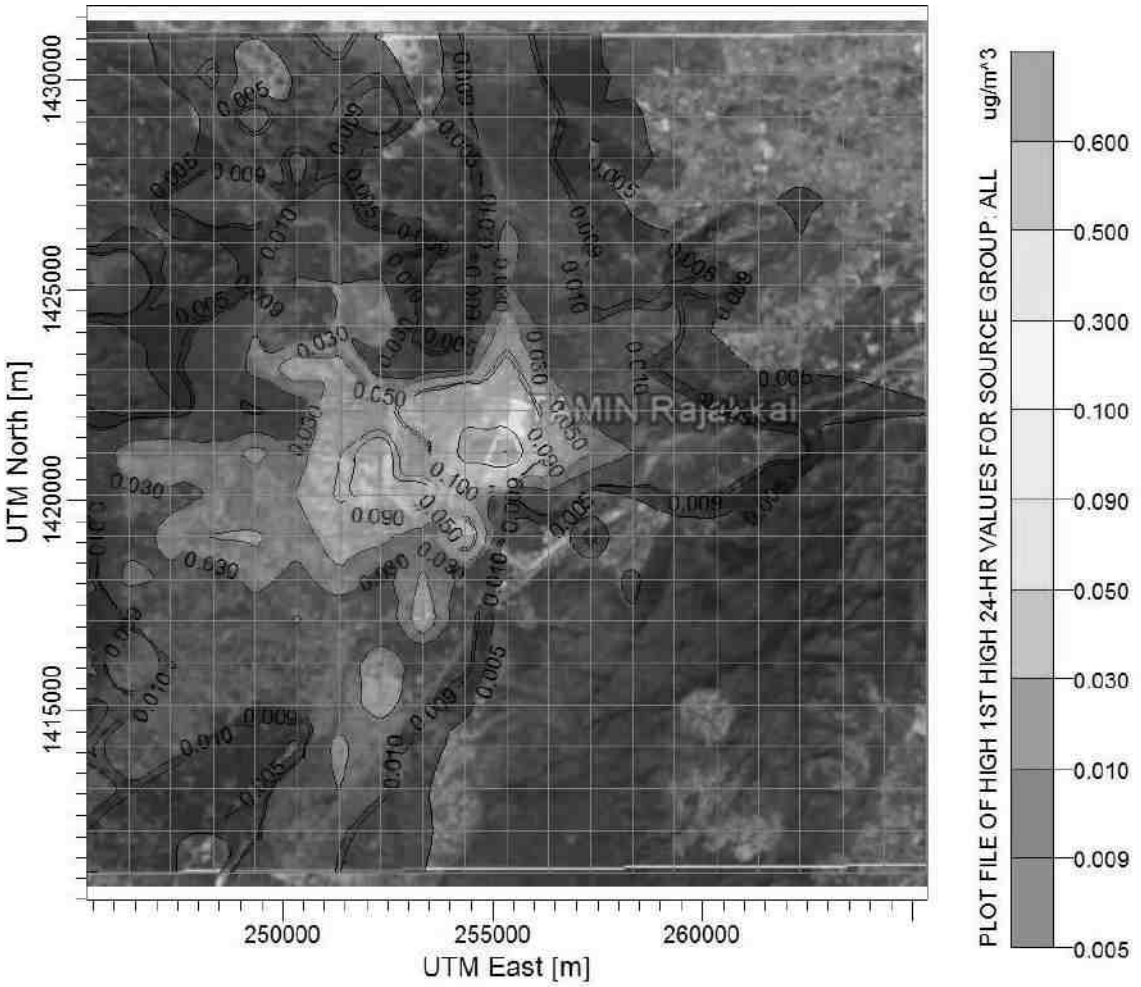


**Figure 4-3 Predicted 24 hrs GLC's of $PM_{10}$ within 10 km radius of the Study area**

**Table 4-11 Predicted Top 10 Highest Concentration of $PM_{10}$**

| S.NO | UTM coordinates (m) | | Conc. ($\mu g/m^3$) | Distance from Centre of the project (km) | Direction from project Centre |
|---|---|---|---|---|---|
| | E | N | | | |
| 1. | 255340 | 1421136 | 0.51271 | Project Site | |
| 2. | 254340 | 1421136 | 0.37748 | 1 | W |
| 3. | 254340 | 1422136 | 0.26931 | 1.41 | NW |
| 4. | 255340 | 1422136 | 0.21847 | 1 | N |
| 5. | 253340 | 1422136 | 0.18328 | 2.24 | WNW |
| 6. | 254340 | 1419136 | 0.14328 | 2.24 | SSW |
| 7. | 253340 | 1420136 | 0.12621 | 2.24 | WSW |
| 8. | 252340 | 1421136 | 0.12306 | 3 | W |
| 9. | 255340 | 1423136 | 0.12281 | 2 | N |
| 10. | 252340 | 1420136 | 0.11842 | 3.16 | WSW |

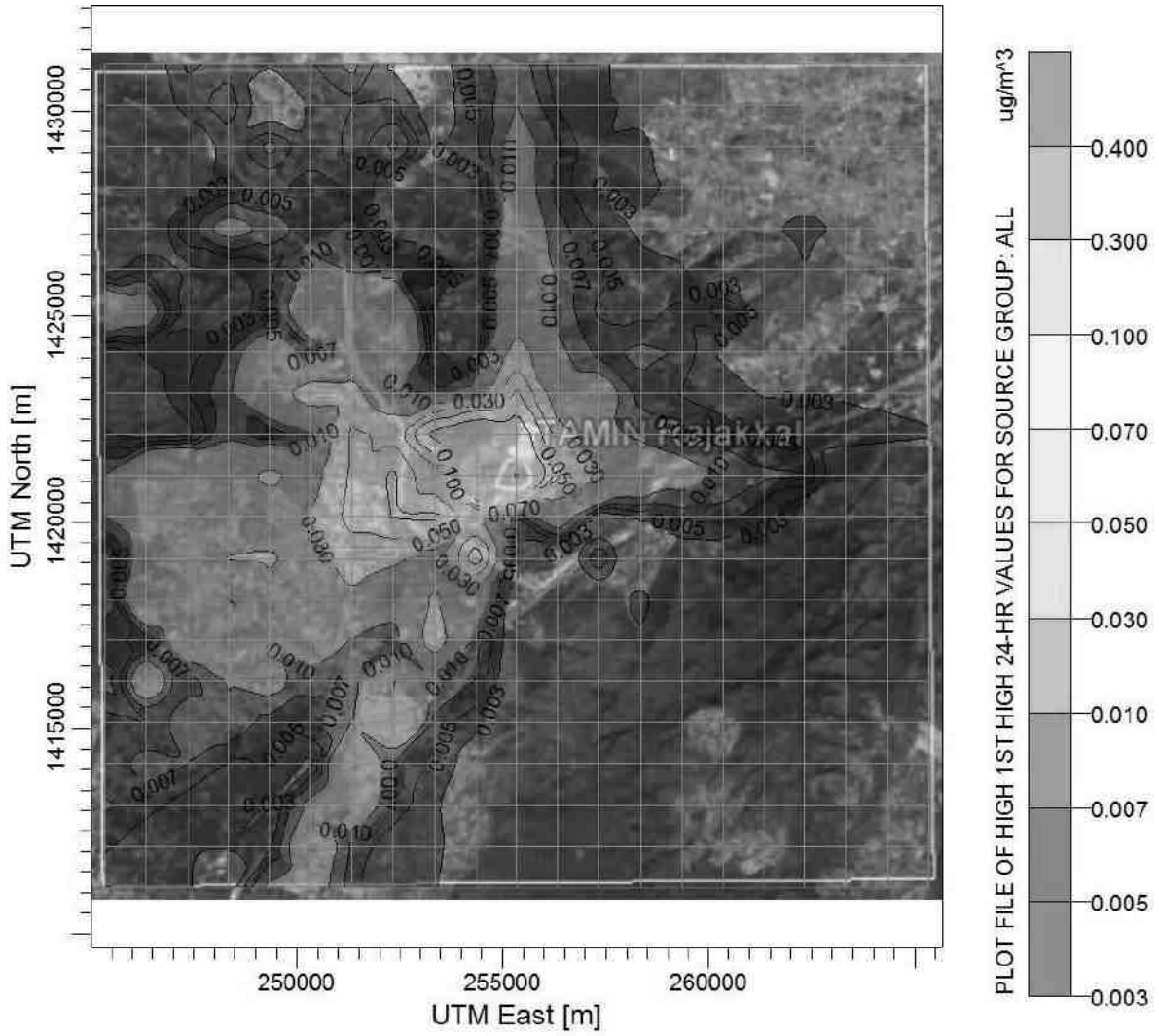


**Figure 4-4 Predicted 24-Hrs' GLC's of PM $_{2.5}$ within 10 km Radius of the Study Area**

**Table 4-12 Predicted Top 10 Highest Concentration of PM $_{2.5}$**

| S.NO | UTM coordinates (m) | | Conc. (µg/m$^3$) | Distance from Centre of the project (km) | Direction from project Centre |
|---|---|---|---|---|---|
| | E | N | | | |
| 1. | 255340 | 1421136 | 0.30836 | Project Site | |
| 2. | 254340 | 1421136 | 0.22698 | 1 | W |
| 3. | 254340 | 1422136 | 0.16189 | 1.41 | NW |
| 4. | 255340 | 1422136 | 0.13139 | 1 | N |
| 5. | 253340 | 1422136 | 0.11019 | 2.24 | WNW |
| 6. | 254340 | 1419136 | 0.08615 | 2.24 | SSW |
| 7. | 253340 | 1420136 | 0.07597 | 2.24 | WSW |
| 8. | 252340 | 1421136 | 0.07392 | 3 | W |
| 9. | 255340 | 1423136 | 0.07381 | 2 | N |
| 10. | 252340 | 1420136 | 0.07117 | 3.16 | WSW |

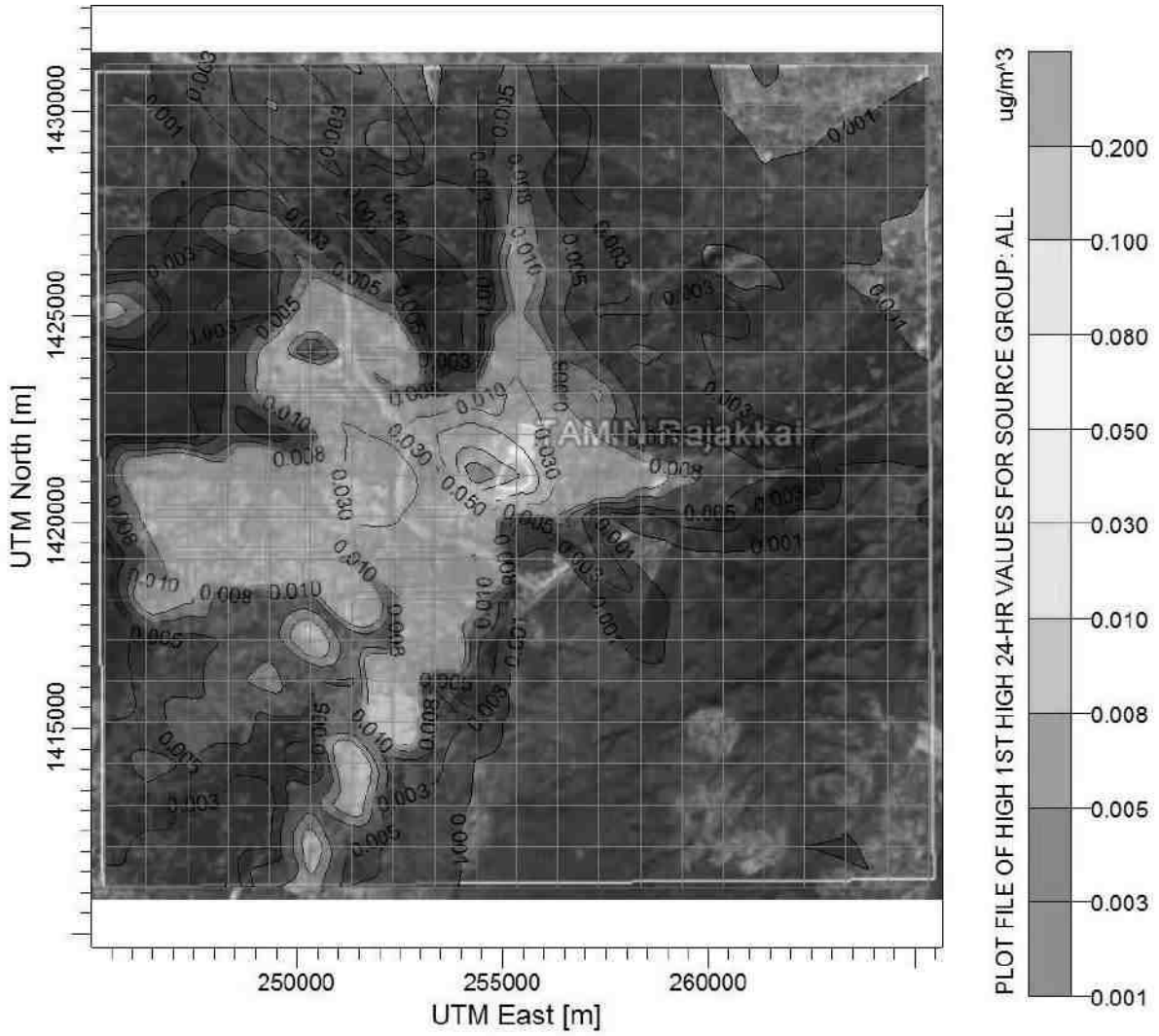


**Figure 4-5 Predicted 24-Hrs' GLC's of $SO_2$ within 10 km Radius of the Study Area**

**Table 4-13 Predicted Top 10 Highest Concentration of $SO_2$**

| S.NO | UTM coordinates (m) | | Conc. ($\mu g/m^3$) | Distance from Centre of the project (km) | Direction from project Centre |
|---|---|---|---|---|---|
| | E | N | | | |
| 1. | 254340 | 1421136 | 0.11889 | 1 | W |
| 2. | 255340 | 1421136 | 0.0839 | Project Site | |
| 3. | 254340 | 1422136 | 0.06706 | 1.41 | NW |
| 4. | 253340 | 1422136 | 0.04836 | 2.24 | WNW |
| 5. | 252340 | 1421136 | 0.04596 | 3 | W |
| 6. | 255340 | 1422136 | 0.04175 | 1 | N |
| 7. | 255340 | 1423136 | 0.0372 | 2 | N |
| 8. | 251340 | 1421136 | 0.03563 | 4 | W |
| 9. | 251340 | 1422136 | 0.03223 | 4.09 | WNW |
| 10. | 252340 | 1420136 | 0.03215 | 3.16 | WSW |

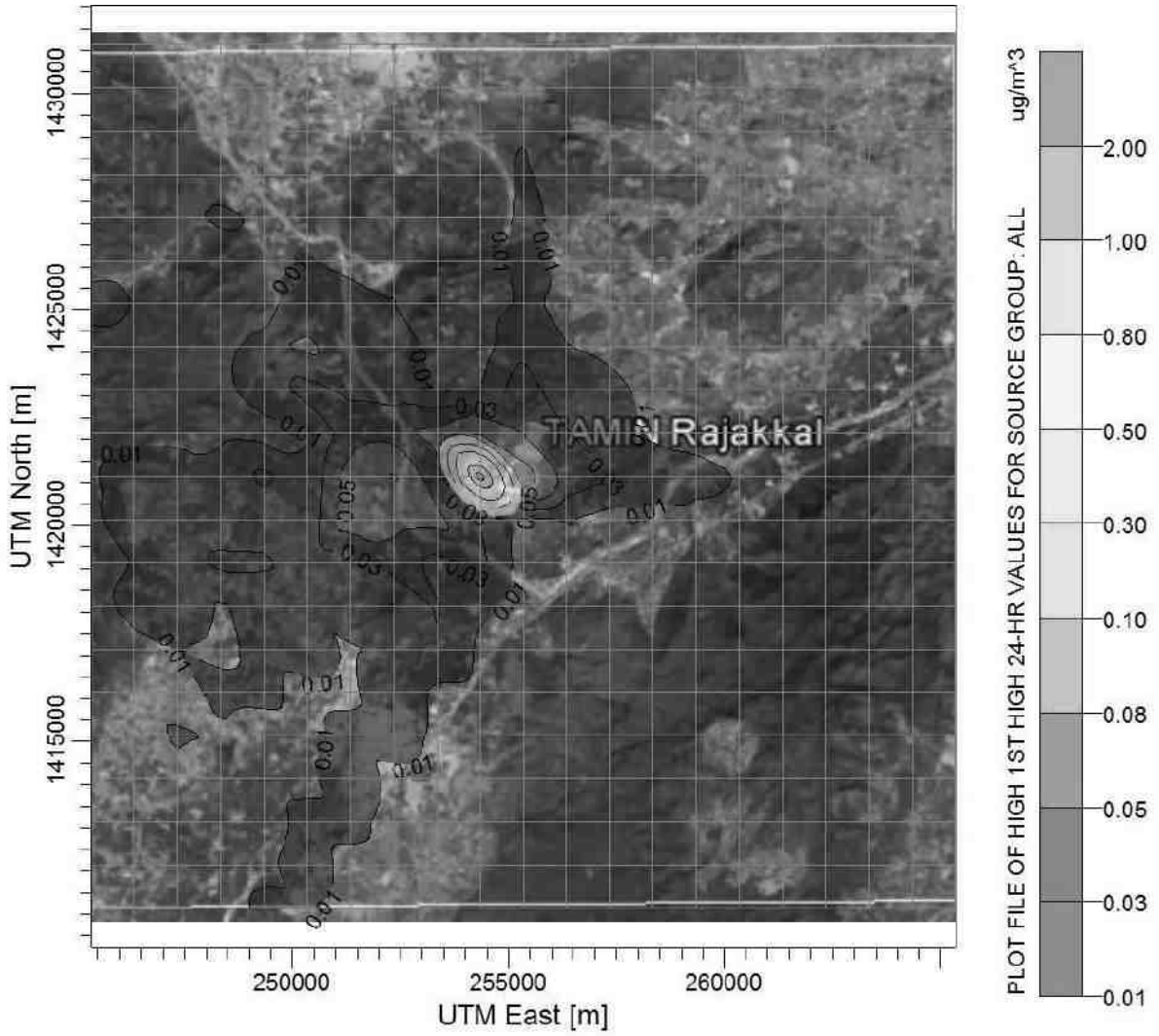


**Figure 4-6 Predicted 24-Hrs' GLC's of $NO_x$ within 10 km Radius of the Study Area**

**Table 4-14 Predicted Top 10 Highest Concentration of $NO_x$**

| S.NO | UTM coordinates (m) | | Conc. ($\mu g/m^3$) | Distance from Centre of the project (km) | Direction from project Centre |
|---|---|---|---|---|---|
| | E | N | | | |
| 1. | 254340 | 1421136 | 1.08746 | 1 | W |
| 2. | 255340 | 1421136 | 0.09793 | Project Site | |
| 3. | 252340 | 1421136 | 0.08198 | 3 | W |
| 4. | 254340 | 1422136 | 0.07829 | 1.41 | NW |
| 5. | 251340 | 1420136 | 0.06289 | 4.09 | WSW |
| 6. | 251340 | 1421136 | 0.05919 | 4 | W |
| 7. | 252340 | 1420136 | 0.05716 | 3.16 | WSW |
| 8. | 253340 | 1422136 | 0.05647 | 2.24 | WNW |
| 9. | 253340 | 1420136 | 0.05575 | 2.24 | WSW |
| 10. | 255340 | 1422136 | 0.04938 | 1 | N |

### 4.2.2 Conclusion:

The total increase in concentrations above baseline status to estimate the percentage increase is summarized in **Table 4-15.**

**Table 4-15 Total Maximum GLCs from the Mining Emissions**

| Pollutant | Max. Base Line Conc. (µg/m$^3$) | Estimated Incremental Conc. (µg/m$^3$) | Total Conc. (µg/m$^3$) | NAAQ standard | % contribution of concentration above Base line |
|---|---|---|---|---|---|
| TSPM | 171 | 2.34 | 173.34 | 500 | 1.37 |
| $PM_{10}$ | 68.4 | 0.51 | 68.91 | 100 | 0.75 |
| $PM_{2.5}$ | 30.7 | 0.30 | 31 | 60 | 0.98 |
| $SO_2$ | 10.2 | 0.11 | 10.31 | 80 | 1.08 |
| $NO_X$ | 23.6 | 1.08 | 24.68 | 80 | 4.58 |

## 4.3 Impacts due to Transportation

The Granite dimensional blocks are transported to consumer directly as per buyer's requirement. The mine is in operation since 1998 and granite is being transported through existing road by trippers and approx. no. of trips required is 2 times per week. This minimum trip does not create impact on existing transportation.

### 4.3.1 Mitigation Measures

The increment in the dust emissions will be mainly due to transportation activity. Therefore emissions due to mineral handling during mining operation are not much and restricted to the lease area only.Proper mitigation measures are practiced during mining activities to control air pollution load below the prescribed limits are as follows:

- Regular water sprinkling on haul and access roads.
- Haul roads to be maintained by surface grading to minimize excessive road surface wearing.
- Watering of haul roads and other roads at regular intervals
- Provision of green belt by vegetation for trapping dust.
- Greenbelt development along the haul roads, dumps and along the boundaries of the lease area.
- Utmost care will be taken to prevent spillage of sand and stone from the trucks.

## 4.4 Water Environment

The existing water environment quality has been studied and the study results are discussed in Chapter-III, which show that generally the water quality in the area is well within statutory standards.

The major sources of water pollution due to this quarry operation will be as below:

- Domestic effluent from the mine.

- Wastewater from Machineries cooling
- Mine discharge water pumped out from the mines
- Reduction in groundwater availability
- Due to poor aquifer condition the impact on water level will be confined to few hundred.
- Deterioration in surface / ground water quality of receiving body.
- Reduction in surface and groundwater availability for domestic and for irrigation purposes.
- Changes to hydraulic regime.

### 4.4.1 Wastewater Generation

There is no process effluentgeneration; the negligible quantity of domestic sewage of 0.42KLD is disposed through septic tank.

### 4.4.2 Mitigate Measures

**Surface Water Pollution Control Measures**

- Construction of garland drains of suitable size around mine area and dumps to prevent rain water descent into active mine areas.
- During monsoon season, the rain water is being collected by natural slope of area to water fed tank of the mine and it will be utilized for dust suppression and greenbelt development.
- The dump tops will be provided with inner slopes to control water flow to prevent erosion washouts. The dumps tops and slopes of in active areas will be covered with grasses, shrubs, mulching, etc, to prevent erosion,
- Retaining walls of adequate dimensions will be provided at the top of dumps and the unstable OB benches within the mine to prevent wash off from dumps and sliding of material from benches. This will help in preventing silting of water drains/channels
- The water channels/drains carrying the rain water from the mine will be provided with baffles and settling pits to arrest the suspended solids, if any, present in this water
- The worked out slopes will be stabilized by planting appropriate shrub/grass species on the slopes.
- The mine water will be regularly tested for presence of any undesirable elements and appropriate measures will be taken in case any element is found exceeding the limits prescribed by CPCB

**Ground Water Pollution Control Measures**

- The domestic sewage from the canteen and toilets will be routed to septic tanks.
- Regular monitoring of water levels and quality in the existing open wells and bore well in the vicinity will be carried out.

### 4.4.3 Rain Water Harvesting

- The rainwater is being diverted towards the middle of the mine to prevent water entering the mine working. The rainwater flows will also contain fines both from surface and waste dumps during seasonal flows. As such, it is being proposed to have structures in such a way to act as settling pond and also for rainwater harvesting.
- Construct barriers at suitable intervals along the path of the drains.
- Divert the water to de-silting cum rainwater harvesting pond in the mine area.
- Provide necessary overflow arrangement to maintain the natural drainage system.

## 4.5 Drainage pattern and Hydrogeology

- Catchment area inside the mine will be affected.

### 4.5.1 Mitigation measures

The study has recommended new alignment in line with upstream drainage slope of the area to facilitate smooth entry of water into the diversion channel and ultimate discharge of water into the original stream. No reduction in surface run-off is envisaged.

## 4.6 Impact of Noise / Vibrations & Mitigation Measures

### 4.6.1 Impact of Noise on Working Environment

The main sources of noise in the mine are as follows:

- Transportation vehicles
- Loading & unloading of minerals.
- Drilling

### 4.6.2 Noise due to Drilling, Excavation and Transportation

The noise levels in the working environment will be maintained within the standards prescribed by Occupational Safety and Health Administration (OSHA). These standards were established with the emphasis on reducing the hearing loss. The permissible limits, as laid down by OSHA, are presented in**Table 4-16.**

**Table 4-16 Permissible Exposure in Cases of Continuous Noise (OSHA, Govt. of India)**

| S.No | Sound Level (dBA) | Continuous Duration (Hours) |
|---|---|---|
| 1 | 85 | 8 |
| 2 | 88 | 4 |
| 3 | 91 | 2 |
| 4 | 94 | 1 |
| 5 | 97 | 0.5 |
| 6 | 100 | 0.25 |

### 4.6.3 Noise Due to Blasting

The main sources of noise in quarrying activity are drilling & Excavators. The blasting activity being minimum, the noise generated will be minimal. The blasting effect will be contained within the quarry lease area. Blasting activities are involved in this Quarry as green belt will be developed around the mine which restricts the propagation of noise.

Following mitigation measures should be taken to control noise pollution:

- Plan Blasting in a way keeping the atmospheric conditions to reduce the fallout.
- Controlled blasting techniques to be utilised.
- Wherever the noise levels exceed 85 dB A, workers should be provided with earmuffs, ear plugs etc.
- All vehicles and machinery will be properly lubricated and maintained regularly.
- Speed of the Vehicles entering and leaving the quarrying lease will be limited to 25 kmph.
- Unnecessary use of horns by the drivers of the vehicles shall be avoided.

### 4.6.4 Noise Impact Analysis on Community

In Industrial area day time noise levels was about 53.6 dB (A) and 42.7 dB(A) during night time, which is within prescribed limit by MoEF & CC (75 dB (A) Day time & 70 dB(A) Night time).

In residential area day time noise levels varied from 50.7 dB (A) to 54.2dB(A) and night time noise levels varied from 40.3 dB(A) to 43.7 dB(A) across the sampling stations. The field observations during the study period indicate that the ambient noise levels in Residential area are all well within the limits.

In summary, it can be stated that the impact on the present noise levels due to mining operations will be restricted to the work zone areas only. The impact on the ambient noise levels will not be felt at the settlement areas due to masking effect with the existing noise levels. Hence, the noise levels impact due to the mining operations on community is insignificant.

### 4.6.5 Mitigate Measures

- Controlled blasting with proper spacing,burden and stemming will be maintained
- No secondary blasting
- Minimum quantity of detonating fuse will be consumed by using alternatively Excel non-electrical initiation system
- The blasting will be carried out during favourable atmospheric condition and less human activity timings
- The prime movers/diesel engines will be properly maintained
- Provision of sound insulated chambers for the workers deployed on machines (HEMM)

- Proper designing of plant & machinery by providing inbuilt mechanism like silencers, mufflers and enclosures for noise generating parts and shock absorbing pads at the foundation of vibrating equipment
- A thick tree belt will be provided in phased manner around the periphery of the mine to attenuate noise
- Trees will be planted on both sides of haul roads
- Personal Protective Equipment (PPE) like ear muffs/ear plugs will be providedto the operatorsof HEMM and persons working near HEMM and reducing the exposure time of workers to the higher noise levels.

## 4.7 Impact of Vibration

Blasting activities are involved in Granite Quarry operations. The vibration during the moment of machinery will be minimal for a short span that will be well within the prescribed limits. Proposed Peripheral green belt is being developed in 0.21.5 Ha. This will mitigate the Vibration.

### 4.7.1 Mitigate Measures

- Proper quantity of explosive, suitable stemming materials and appropriate delay system are to be adopted for safe blasting.
- Safe blasting zones are kept around the periphery of the quarry
- Overcharging will be avoided
- The charge per delay will be minimized and preferably a greater number of delays will be used per blasts

## 4.8 Impact on Human Settlement

The total lease area is 46.07.0 Ha which Governmentporamboke land. TAMIN obtained the quarry lease was applied quarry lease vide G.O. (3D) No. 75, Industries (MME-1) dept dated 03.09.2007 for 20 years & the lease period is valid up to 16.09.2027. Hence R&R Plan is not required for this Quarry.There are no monuments or places of worships in mine area. Ground vibration and noise pollution is being maintained minimal and confined to the mine area. The quality of water both surface and ground water is good and all parameters of drinking water are as per IS standards. Water quality analysis will be carried out at periodical intervals during post project monitoring. The PM, $NO_2$ and $SO_2$ have been observed to be below the prescribed limit. Noise levels have also been found to be below the permissible limits at all the locations. Further, the noise generated in the lease area will get attenuated due to plantation and green belt all around the lease area. As preventive measures, greenbelt development around the mine lease area will be further strengthening for control of air emission to environment.

All the employees when inducted will be medically examined. Further, they will also be medically examined at periodical interval.

## 4.9 Biological Environment

### 4.9.1 Mining activities and their impact on biodiversity

**Table 4-17 Impacts on Biodiversity**

| S. No | Activity | Examples ofaspects | Examples of biodiversity impact |
|---|---|---|---|
| **1.** | Extraction | Land clearing | Loss of habitat, introduction of plant diseases,Siltation of water courses |
| **2.** | Blasting, Digging andhauling | Dust,noise,vibration,waterpollution | Disruption of water courses,impacts on aquatic ecosystems due to changes in hydrology and water quality |
| **3.** | Waste dumping | Clearing, water and soil pollution | Loss of habitat, soil and water contamination, sedimentation, acid mine drainage |
| **4.** | Tailing management | Land clearing, water pollution | Loss of habitat, toxicity, sedimentation, water quality and stream flow |
| **5.** | Air emissions | Air pollution | Loss of habitat or species |
| **6.** | Waste disposal | Oil and water pollution | Encouragement of pests, disease transfer, contamination of groundwater and soil |
| **7.** | Building power lines | Land clearing | Loss or fragmentation of habitat |
| **8.** | Provision of accommodation | Land clearing, soil and waterpollution, waste generation | Loss of habitat, sewage disposal and disease impacts |
| **9.** | Access roads | Land clearing | Habitat loss or fragmentation, water logging upslope and drainage shadows down slope |
| **10.** | Population growth | Land clearing or increasedhunting | Loss of habitat or species, stress on local and regional resources, pest introduction, clearing |
| **11.** | Water supply (potable or industrial) | Water abstraction or mine dewatering | Loss or changes in habitat or species composition |

### 4.9.2 Existing Biological Scenario

- Pallalakuppam, Sanankuppam, Amburdrug, Ambur, Charagallui, Pallalakuppam Extension, Kampasamudram, Karapattu, Gundalapalli, Mordana Extension Reserve Forests are located within the 15km radius of the project. Other than these, there is one Koundinya Wildlife sancturary is located at a distance of 13018km (NW) within 10km from the mines. There will not be any adverse impact due to mining operations in this lease since only small production is involved from this lease and there will not be any major polluting source from the mining operations. Besides, all necessary mitigation measures will be implemented.
- There is no perennial water body near the site and there will be no discharge of effluent from the mine.

- In the Quarry area or its proximate areas there is no wetland and the natural flow of water not available.
- There is no rare or endangered species
- There are no wild animals in the area. In the post mining stage, proper fencing will be carried in the mined out area to prevent fall of animals in the mine pits.
- No such significantly important medicinal value species within both the ML areas and its nearby region.
- There are no any wetlands, fish breeding grounds, marine ecology nearby the quarry area, which will be affected due to this project.

### 4.9.3 Mitigate Measures

To reduce the adverse effects on flora/fauna status that are found in project area due to deposition of dust generating from mining operations, water sprinkling and water spraying systems will be ensured in all dust prone areas to arrest dust generation.

## 4.10 Flora and Fauna

Activities of Mine development and operations & transportation to end users will cause the following impacts on flora and fauna.

### 4.10.1 Impact

- Displacement of existingfauna.
- Lossofvegetation

### 4.10.2 Mitigation measures

- Renovation of ponds
- Construction of check dams and water holes; Engagement of fire watchers.
- Education and training etc.
- Logistic support in form of equipment, Vehicles etc as required by the implementing DFO will be extended.

The objectives of the green belt cover will cover the following

- Noise abatement
- Reuse of waste water to the extent possible
- Prevention of soil erosion
- Ecological restoration
- Aesthetic, biological and visual improvement of area due to improved vegetative and plantation covers.
- Green belt around mine, dumps, etc:
    - Tall growing, closely spaced, evergreen trees native to the area

- Easy, quick early growth and establishment
- Uniform spreading of crown habit.
- Timber trees having long gestation period.
- Trees with high foliage density, leaves with larger leaf area
- Attractive appearance with both good flowering and fruit bearing.
- Bird and insect attracting species
- Suitable green cover with minimal maintenance

➢ Avenue Trees:

- Trees with conical canopy and with attractive flowering
- Trees with medium spreading branches to avoid obstruction to the traffic
- Trees with branching at 10 feet and above.

**Table 4-18 Conservation Plan for P eacock for five years conservation Plan**

| S.No | Work or Activity | 1 to 5 years | Location |
|---|---|---|---|
| 1. | Plantation | 100 trees per year plant of local plant species for five years in villages. | Villages covered in 10 km study area |
| 2. | Water filling | 5 number in water hole filing during summer. | Ponds covered in 10 km study area |
| 3. | Awareness | In school of nea/rby villages for peacock conservation as Drawing Competition. (Peacock Picture) & Essay Writing on Peacock. | Villages covered in 5 km study area |
| ***All above activity will be carried out with the consultation of Ecologist* | | | |
| Plant Species will be suggested by the Ecologist and plant saplings will be distributed in project villages as per the above mentioned schedule (year wise). | | | |

## 4.11 Green Belt Development

The green belt plantation programme will be continued till the end of the mining operation in the area. In framing out this programme on a sustainable and scientific base, due consultation and coordination with the forest department will be sought.

Plants are chosen to provide aesthetic, ecological and economical value. Trees will help to arrest propagation of noise and help to lessen dust pollution due to dust arresting action. The existing plantation will be developed inside the mining lease is about 2.39.0 Ha out of 46.07.0 ha.

The soil dumps, are planted to prevent erosion and for stabilization of the soil. Plants are chosen to provide aesthetic, ecological and economical value. Trees will help to arrest propagation of noise and help to lessen dust pollution due to dust arresting action.

## 4.12 Impacts on Occupational Health Due to Project Operations

Anticipated occupational illness sequel to mining activities involved in the project as follows

- Dust related pneumonia
- Tuberculosis
- Rheumatic arthritis
- Segmental vibration

### 4.12.1 Mitigate Measures for Occupational Health

- Adoption of dust suppression measures like spraying water, use of drill with dust collection system or wet drills etc.
- Plantation
- Avoid blasting during unfavorable wind & atmospheric conditions
- Use of personal protective equipment. Compliance with DGMS circulars
- Emergency response plan that includes installation of emergency response equipment to combat events such as fire.
- All personnel required to handle hazardous materials will be provided with personal protective equipment suitable for the hazardous material being handled.
- On-site first aid facilities will be provided and employees will be extended to the local community in emergencies.

**Table 4-19 Mitigation for occupational health and safety**

| S. No | Activity | Mitigation measures |
|---|---|---|
| 1 | Excavation | Planned excavation, avoid haphazard mining |
| 2 | Drilling and blasting | ➢ Driller should be equipped with a closed cabin to reduce exposure to noise and dust.<br>➢ In addition, the operators and other workers should be provided with masks, helmets, gloves and earplugs. |
| 3 | Safety zone | ➢ Provisions for a buffer zone between the local habitation and the mine lease in the form of a green belt of suitable width.<br>➢ Restricted entry, use of sirens and cordoning of the lasting area are some of the good practices to avoid accidents. |
| 4 | Overburden stabilization | ➢ Accidents are known to happen due to overburden collapse.<br>➢ Therefore, slope stabilization and dump stability are critical issues for safety and environment. |
| 5 | Worker's health surveillance | ➢ Health survey programmes for workers and local community.<br>➢ Regular training and awareness of employees to be conducted to meet health and safety objectives. |

### 4.12.2 Mitigate Measures for Safety Aspects

- To reduce pollution emanation from quarry operations carry out splitting of sheet rock by diamond wire saw which largely reduces the dust and noise generation.Water sprinkling on haul roads and dumping yards, etc.
- Green belt creation wherever possible to arrest dust and reduce noise propagation.
- All staff and workers will be provided with PPE to guard against excess noise levels
- Provision of safety Helmets, goggles, safety boots, ear muffs, gas masks, etc.
- To provide appropriate instruction, training, retraining, vocational training, etc.
- Organization of safety contests and safety campaigns regularly to update knowledge of safe operational procedures, etc.
- Observation and compliance of all precautions, control measures and stipulations on above lines will ensure that in this project, health and safety problems will be minimal.

## 4.13 Impacts on Social Environment

Since the entirelease area of boththe project has no habitations or hutments in the core zone area, no rehabilitation or resettlement problems are involved. By adopting various mitigation measures as explained earlier, the environmental scenario in respect of ambient air quality, water quality, Noise levels, water aspects, biological aspects etc. during the operation of the project will be maintained within the statutorily prescribed levels. As such, impact due to the projects will be positive on socio-economic aspects. It will be ensured that the buffer zone of the quarry will be properly preserved environmentally in all respects within sustainable limits through necessary monitoring. The project will be operated with due care for minimizing environmental impacts with proper EMP measures for pollution control. indirectly scores of people will be benefited by gainful indirect employment opportunities through various service related activities connected with the project operations as shown under.

## 4.14 Corporate Environmental Responsibility

TAMIN Rajakkal site had no Relocation and Rehabilitation. Most villages have benefitted mutually at Rajakkal where the mining industry has provided indirect jobs for labor and villages provide accommodation for the labor and staff. Supportive industries like food supply and essential shops are economic growth in the villages. The site has provided road access to a few nearby village sites. TAMIN Provision for CER activities will be implemented as per MoEF&CC O.M dated20th October, 2020 (F.No. 22-65/2017-IA.III):

**Other benefits to Community**

- Project related logistical operations.
- Various trading services for consumer goods, spare parts, sundry items, etc.

- Contractual services connected with the project.
- Green belt works in the project.
- Casual labor needs for various activities.

The project will provide ample opportunity to the local people for direct and in-direct employment. The proposed project may create opportunities for indirect employment in the field of vehicle hiring, labours, trading of construction materials, carpenters etc. The major areas which required immediate attention relates to infrastructure support, health & sanitation, Anganwadi services, school education, youth development, income generation activities & veterinary services.

# 5 ANALYSIS OF ALTERNATIVES

## 5.1 Alternate Technology

Semi mechanized opencast method is being involved in this Quarry.No alternative technology will be envisaged for this proposed enhancement project.

## 5.2 Method of mining

### 5.2.1 Opencast Method

Open cast, semi-mechanized mining with 6 m vertical bench with a bench width not less than bench height has been proposed. Under the regulation 106(2) (a) of the Metalliferous Mines Regulation 1961 in all open cast working in hard ore body, the benches and sides should be properly benched and sloped. The height of any bench shall not exceed 6m and the width thereof shall not be less than the height. The benches shall be sloped at an angle of more than 60° from the horizontal.

## 5.3 Alternate Site

The mineral deposits are site specific in nature; hence question of seeking alternate site does not arise. The project site is located at S.F.No. 311(Part), over an extent of 46.07.0 Ha, Rajakkal Village, Pernambut Taluk (Erstwhile Gudiyatham Taluk), Vellore District, Tamil Nadu. It is Government Poramboke land the applicant has obtained lease from the Government is enclosed as **Annexure - I.**

## 5.4 Connectivity

The nearest railway station is Pachchakuppam railway station which is about 2.40 km on South East side. The project site is adjacent to the SH 130 i.e. Gudiyatham - Vaniyambadi road approximately 0.19 km on South direction. The NH 48 Chennai - New Delhi road is around 2.30 km in the SE direction.

# 6 ENVIRONMENTAL MONITORING PROGRAMME

## 6.1 General

The mitigation measures suggested in **Chapter 6** will be implemented so as to reduce the impact on the environment due to the operations of the project. The monitoring schedules are planned for systematic study of various pollution levels with respect to air and water qualities, noise levels, etc. to ensure that they conform to the standards laid down by Environmental Protection Act and various Central and State Pollution Control Board Limits. The various methodologies and frequency of studies of all environmental quality parameters also conform to norms laid down by MOEF, CPCB and SPCB in this respect.

The Project proponent of quarry will be overseeing/reviewing following activities:

- To observe the implementation of environmental control measures.
- To ensure implementation of planned plantation programme with monitoring of survival rate, etc.
- To keep monitoring records properly for submission of periodical returns to statutory authorities and for checking by them.
- To evaluate periodically the performance of existing pollution control equipment and systems for taking prompt action in this respect to rectify the defects.
- Conducting safety audits and programmes to create safety awareness in workers/staff.
- Monitoring of dumps and benches for slope stability, monitoring of OB dumps, laying of check dams, garland drains around the dumps and excavated areas and their regular maintenance for de-silting.
- To study the effects of project activities on the environment.
- To interact and liaise with State and Central Government Departments.
- To take immediate preventive action in case of some unforeseen environmental pollution attributable to the project.
- Imparting training on safety and conduct safety drills to educate employees.
- To ensure that firefighting equipment, etc, are kept in ready-to-use condition.

For each of the environmental attributes, the monitoring plan specifies the parameters to be monitored, location of monitoring sites, frequency and duration of monitoring and it also denotes the applicable standards, implementation and supervising responsibilities.

## 6.2 Monitoring Schedules for Various Environmental Parameters

The proponent shall adopt the following monitoring schedule for environmental parameters. However, based on the need and priority it may be suitably modified / improved. However, since the proponents are different, monitoring, fulfilling of all the statutory obligations and maintaining records are to be carried out separately by the proponents.

### 6.2.1 Ambient Air Quality

The following monitoring schedule is given for ambient air quality.

- **Parameters**

  Sulphur dioxide ($SO_2$), Oxides of Nitrogen (NOx), Suspended Particulate Matter (SPM), Respirable Particulate Matter (PM- 2.5/10).

- **Frequency of Monitoring**

  Once in a year in each location.

- **Location**

  2 or 3locations in buffer zone and 1 location in work zone. The environmental standards for Ambient air quality prescribed by CPCB/MOEF/SPCB.

### 6.2.2 Water Environment

Water quality monitoring at least before and after monsoon from ground water near the lease area and mine pit water sample shall be monitored. General, Physical and chemical parameters, COD, BOD, TSS etc shall be analyzed.

### 6.2.3 Noise Measurement

Work Zone noise and Ambient Noise level shall be monitored at least once in a year. Noise monitoring at ambient air monitoring locations will be carried out. Besides, vibration studies in the nearby villages shall be carried out, as per necessity and direction of DGMS, etc. The noise level standards as given by CPCB / MOEF given in **Table 6-1** will be enforced in the mine.

**Table 6-1 Environment (Protection) Rules 1986**

| S. No | Area Code | Category of area | Limits in dB(A) Leg | |
|---|---|---|---|---|
| | | | Day Time | Night Time |
| 1 | A | Industrial area | 75 | 70 |
| 2 | B | Commercial area | 65 | 55 |
| 3 | C | Residential area | 55 | 45 |
| 4 | D | Silence Zone | 50 | 40 |

**Note:**

- Day time shall mean from 6 a.m. and 10.0 p.m.
- Night time shall mean from 10.0 p.m. and 6 a.m.

- Silence zone is an area comprising not less than 100 meters around hospitals, educational institutions, courts, religious places or any other area which is declared as such by the competent authority.
- Mixed categories of areas may be average as one of the four above mentioned categories by the competent authority.

* dB(A) Leq denotes the time weighted average of the level of sound in decibels on scale A which is relatable to human hearing.

A "decibel" is a unit in which noise is measured.

"A", in dB(A) Leq, denotes the frequency weighting in the measurement of noise and corresponds to frequency response characteristics of the human ear.

*Leq: It is energy mean of the noise level over a specified period.*

### 6.3 Post Project Environmental Monitoring

It is imperative that the Project Authorities set up regular monitoring stations to assess the quality of the neighboring environment of the project. An environmental monitoring programme is important as it provides useful information and helps to:

- Verify the predictions on environmental impacts presented in this study
- Assist in detecting the development of any unwanted environmental situation, and thus, provides opportunities for adopting appropriate control measures, and
- Identify the effectiveness of mitigate measures suggested in the EMP.

**Table 6-2 Post Project Environmental Monitoring Program**

| S. No | Area of Monitoring | Number of Sampling Stations | Frequency of Sampling | Parameters to be Analyzed |
|---|---|---|---|---|
| 1. | Meteorology | One | Hourly and Daily basis. | Wind speed and direction, Temperature, Relative Humidity, Atmospheric pressure, Rainfall. |
| 2. | Ambient Air Quality | 2 Stations (In downwind) | Twice a week:24 hourly period | $PM_{10}$, $PM_{2.5}$, $SO_2$, VOC and $NO_2$ |
| 3. | Noise | 2 (two within plant premises and two outside plant premises) | Once every season | Ambient Equivalent continuous Sound Pressure Levels (Leq) at day and Night time. |
| 4 | Exhaust from DG set | Stack of DG set | Quarterly | $PM_{10}$, $PM_{2.5}$, $SO_2$ & CO |
| 5 | Vehicular Emissions | Parking area | Periodic monitoring of vehicles | Air emission and noise, PCU |
| 6 | Solid waste / Hazardous waste | Check conformance to HWM rules | Quantity and Quality monitoring | Physical state, Paint Filter Liquid test (PFLT), Loss On Drying (LOD), Loss On Ignition & Calorific Value. |

| | | | | |
|---|---|---|---|---|
| 7 | Soil | Two Locations within the Project Site | Yearly Once | Physico chemical properties, Nutrients, Heavy metals |
| 8 | Terrestrial Ecology | Within 10km, around the project | Once in three years | Symptoms of injuries on plants |
| 9 | Surface/ Ground water quality | Two Locations Within Project Site | Yearly Once | As per ISO 10500 Standard parameters |

### 6.3.1 Occupational Health and Safety

- Occupational health survey of staff and permanent workers will be undertaken at least once in 3 years to detect early incidence of diseases and for prompt remedial medical follow up in the matter. Audiometric test for the workers will be done at regular interval for workers of the noise prone area. Safety matters also will be reviewed periodically by safety in-charge.

- Occupational health and safety is very closely related to productivity and good employer-employee relationship. The main factors of occupational health in mines are fugitive dust and noise. Safety of employees during blasting operation and maintenance of mining equipment and handling of explosive materials is to be taken care of as per the Mine Regulations, 1961 and Circulars of DGMS. To avoid any adverse effects on the health of workers due to dust, heat, noise and vibration, sufficient measures have been proposedin the EMP. These include
    - Provision of wet drilling /or dust collectors
    - Provision of rest shelters for mine workers with amenities like drinking water, fans, toilets etc.
    - Provision of personnel protection devices for the workers
    - Rotation of workers exposed to high noise areas
    - Closed control room in crusher house with proper ventilation
    - First-aid facilities

Occupational Health Survey of the employees will be carried out at regular intervals.

## 6.4 Environmental Monitoring Programme

**Table 6-3 Environmental Management Plan**

| S. No | Salient Items | Proposals as per Scheme of Mining earlier | Position at the end of five years of Scheme of Mining period | Proposals for the next five years plan period |
|---|---|---|---|---|
| 1 | Top Soil storage preservation and utilization | The recovered interstitial soil from the mine will be used for Planting trees and growing vegetation. | As proposed in the Scheme of Mining the top soil stored in the inter boundary of the lease area for plantation purposed | In the ensuing Scheme of Mining-II period also. Top soil will be stored plantation purpose and thus the afforestation programme complied with. |

| | | | | |
|---|---|---|---|---|
| 2 | Land Reclamation | Proposed not to backfill the mine-pit, and will be left as its condition | As proposed in the Scheme of Mining, the mine pit is left its condition | The mine-pit will be utilized asa waterreservoir (or) may be used for fishi-culture purpose. |
| 3 | Waste Dump Management | Proposed to stack the waste in the inner boundary of the lease hold area all along the southern boundary of the field and may used to grow plants. | The waste has been dumped in the inner boundary are as per the proposal | In the next five years period. The waste can be dumped over the existing waste dump in the southern portion of the lease area. |
| 4 | Afforestation Program with precautions for survival and protection of plantation. | Proposed to cover an afforestation 20 plants per year is proposed with the survival rate of 50% | As proposed 20 Plants were planted during the Modified Scheme Period-II along the sourthern boundary of lease area and achieved survival rate of 50 % | In the ensuring 5 years period of Scheme of Mining-III, 20 plants per year is proposed to the planted for complying the afforestation programme with arrived survival rate of 50% in the south eastern portion of the lease area in a phased manner. |
| 5 | Quality of mine water and any interference with surface waters pruces | The proposal for the Confinement of waste dumps arranged to prevent the interference of surface water sources and thus the quality of mine water is good. | Followed the Procedure as proposed in the Scheme of Mining period also. | Proposed the same procedure tobe followed inthe ensuing five years period of Scheme of Mining |
| 6 | Fly rock fragments And precautions | Proposed to follow up low explosives detonating cord can be used to avoid fly rock. Fly rock will be avoided by deploying diamond wire cutting method. | Followed the muffle Blasting procedure and thus prevented the fly rock fragments. Fly rock avoided by diamond wire cutting method. | In the ensuing 5 years scheme of mining period, the same safety precautions willbe followed. Fly rock will be avoided by deploying diamond wire cutting method. |

# 7 ADDITIONAL STUDIES

## 7.1 Introduction

The additional studies involved in this project will consist of following aspects:

1. Public consultation
2. Enumerate the aspects of Violation
3. Quantification of Damage Assessment
4. NaturalResources, Ecological Damage &Remediation Plan and Cost
5. Natural &Community Resource Augmentation Plan
6. Community ResourceAugmentation Plan breakup
7. Risk assessment /Disaster Management Plan
8. Mine closure plan
9. Occupational Health and safety studies have been conducted and a safety plan was prepared.

### 7.1.1 Public Consultation

The project is categorized 'B' category as per EIA Notification 2006; As per MoEF & CC Office Memorandum, dated 3rdJune 2009; EIA Notification, 2006 exempted from undertaking public hearing in existing projects.

However, the project falls under violation category, Public Hearing is Mandatory for violation projects. So, EIA report has been prepared as per the obtained violation ToR vide. F. No. SEIAA-TN/F.No.1652/SEAC/ToR-1343/2023 dated 16.02.2023. Draft EIA report will be submitted for Public Hearing (PH) to Vellore PCB.

After PH, the minutes will be incorporated in the EIA report along with action plan or commitment by the proponent. Final EIA will be submitted to TNSEAC for further appraisal of the project and obtaining Environment Clearance.

### 7.1.2 Enumerate the aspects of Violation

**Quantification of Damage cost**

**Table 7-1 Quantification of Damage cost**

| S. No | Description | Details | Unit | Mining Plan period (As per production details provided by TAMIN) | | | | | SOM-III (2018-2019 to 2022-2023) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 2013-2014 | 2014-2015 | 2015-2016 | 2016-2017 | 2017-2018 | 2018-2019 | 2019-2020 | 2020-2021 | 2022-2023 | 2023-2024 |
| 1 | Mine Lease Area | | Ha | 46.07.0 | 46.07.0 | 46.07.0 | 46.07.0 | 46.07.0 | Nil | Nil | Nil | Nil | Nil |
| 2 | | Qty/ Mining plan | $m^3$/ year | 12060 | 12395 | 12060 | 12395 | 12302 | Nil | Nil | Nil | Nil | Nil |
| | | Actual production | $m^3$/ year | 1206 | 1240 | 1206 | 1240 | 1230 | Nil | Nil | Nil | Nil | Nil |
| | | Total Water Consumption | KL/ year | | | | | | Nil | Nil | Nil | Nil | Nil |
| 3 | Source of water | -- | KL/Y | | | | | | | | | | |
| 4 | Hazardous waste | **--** | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Waste oil | -- | Lits/A | 3 | 3 | 3 | 3 | 3 | | | 0 | 0 | 0 |
| 5 | Municipal Solid Waste | -- | Tonne/ Year | 6.34 | 6.34 | 6.34 | 6.34 | 6.34 | | | Nil | Nil | Nil |
| 6 | Mode of Disposal of Sewage | -- | - | - | Septic tank | Septic tank | Septic tank | Septic tank | Septic tank | Septic tank | -- | -- | -- |
| 7 | Deforestation /No of plants | -- | Nos | - | Nil | Nil | Nil | Nil | Nil | Nil | Nil | Nil | Nil |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8 | Domestic Sewage Quantity | -- | KLD | Nil | Nil | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | Nil | Nil | Nil |
| 9 | Man power | -- | Nos | Nil | Nil | 35 | 35 | 35 | 35 | 35 | Nil | Nil | Nil |

**Enumerate the aspects of Violation**

Quantification of the effects on human health of particulate matter emissions, for which inhalation is the only relevant exposure route. In this case, it is necessary to quantify the pollutant emission, describe its dispersion and the extent to which the population is exposed, apply a concentration-response function and finally evaluate the economic impact. A pathway for estimating impacts& Impact Pathway Approach is shown in **Figure 7-1.**

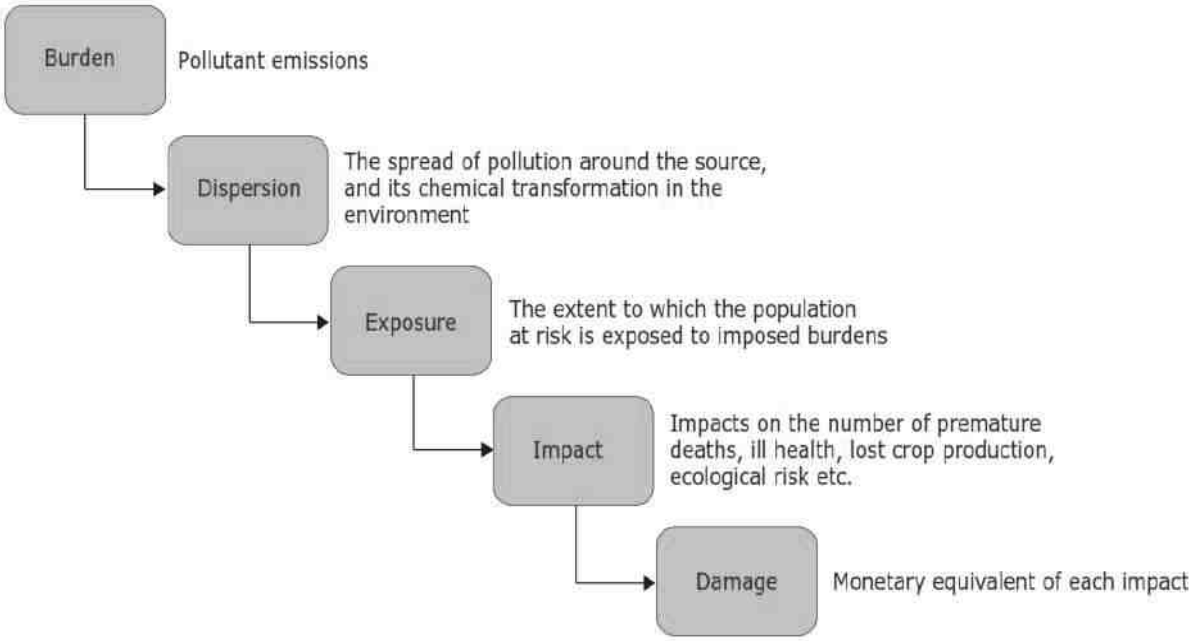


**Figure 7-1 Impact Pathway Approach**

**Source:** *European Environmental Agency - EEA Technical report N15/2011 ''Revealing the costs of air pollution",*

### 7.1.3 Quantification of Damage Cost

Assessment of the damages caused during quarry operations are given below:

**Air Environment**

The major source of air pollution due to emission generation by is quarry machineries & transportation of granite.Drilling, Haul roads, Waste dump & Open pit activities are considered for air emission generation.

**Emission calculation References**

- *The drilling emission is calculated with the equation of Chakraborty, et al. (2002),*
- *The emission factors for the haul roads the equation from the literature Chaulya, (2006).*
- *Haul Roads &Waste dump emission calculated based on the literature Chakraborty, et al., (2002).*

- *Open pitEmission calculation as per the open pit estimation is another tool than the area source in AERMOD. (Neshuku, 2012).*

**Table 7-2 Quantification of Emissions due to quarry activities**

| S. No | Emission details | Emissions quantity Tonne /Year | Total Emissions quantity (Tonne) for 5 years (Violation period) |
|---|---|---|---|
| 1 | TSPM | 5.10 | 25.50 |
| 2 | PM10 | 1.02 | 5.10 |
| | PM2.5 | 0.61 | 3.06 |
| 3 | $SO_2$ | 0.26 | 1.29 |
| 4 | NOx | 5.04 | 25.21 |
| **Total** | | 12.03 | 60.16 |

***Source for project activities:*** *Project proponent*

**Water Environment**

Water is being sourced from nearby road tankers for mining operations purpose is about 1.5 $m^3$/day of water is required for the project.

**Water pollution**

There is no wastewater generation in the quarry. The sewage generated is being collected in Septic tank followed by soak pit. Assuming 100% of the sewage is collected in soak pit contaminating.

**Table 7-3 Year wise Sewage generation in Violation period**

| S. No | Description | Mining Plan period (As per production details provided by TAMIN) | | | | | SOM-III (2018-2019 to 2022-2023) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2013-2014 | 2014-2015 | 2015-2016 | 2016-2017 | 2017-2018 | 2018-2019 | 2019-2020 | 2020-2021 | 2022-2023 | 2023-2024 |
| 1 | Domestic Sewage Quantity (KLD) | 406.4 | 406.4 | 406.4 | 406.4 | 406.4 | Nil | Nil | Nil | Nil | Nil |
| 2 | Sewage collected in soak pit(KLD) | 406.4 | 406.4 | 406.4 | 406.4 | 406.4 | Nil | Nil | Nil | Nil | Nil |

**Table 7-1 Penalty due to Sewage Disposal**

| S. No | Pollutants | KL/Y | Penalty cost KL/A (in rupees) | Total damage Cost/year | Total Cost / 5 year (Productive years) |
|---|---|---|---|---|---|
| 1 | Total Sewage collected in soak pit | 406.4 | 50 | 20320 | 1, 01, 600 |

*Treatment cost of sewage is assumed 100/-

**Noise & Vibration**

Damages during Operation phase there will be minor increase in noise levels due to vehicular movement.

**Table 7-2 Noise pollution damage assessment**

| S. No | Number of Persons | No. of Working days/year | Damage cost per day/person | Damage cost per year | Total Cost / 5 year (Productive years) |
|---|---|---|---|---|---|
| 1 | 35 | 320 | 1 | 11200 | 56,000 |

***Man power Source:*** *Project Proponent*

**Solid Waste**

Municipal solid waste will be generated. If not managed properly, waste will affect the health of staff and employees as well as locals in the surrounding areas and will also be aesthetically unpleasant.

**Table 7-6 Year wise Solid Waste generation in Violation period (5 years)**

| S. No | Description | Mining Plan period (As per production details provided by TAMIN) | | | | | SOM-III (2018-2019 to 2022-2023) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2013-2014 | 2014-2015 | 2015-2016 | 2016-2017 | 2017-2018 | 2018-2019 | 2019-2020 | 2020-2021 | 2022-2023 | 2023-2024 |
| 1 | MSW (Tonne/Year) | 5.04 | 5.04 | 5.04 | 5.04 | 5.04 | Nil | Nil | Nil | Nil | Nil |

**Table 7-3 Penalty due to Solid Waste generation**

| S. No | Pollutants | TPA | TPA INR (Rs) | Total damage Cost/year | Total Cost / 5 year (Productive years) |
|---|---|---|---|---|---|
| 1 | MSW (TPA) | 5.04 | 290 | 1461.6 | 7308 |

**Treatment cost of MSW is assumed 290/-*

**Removal of Trees**

The quarry Lease area is fully rocky terrain. The quarry is in operation since, 1998. As per proponent information there is no removal of trees.

### 7.1.4 Natural Resources, Ecological Damage & Remediation Plan and Cost

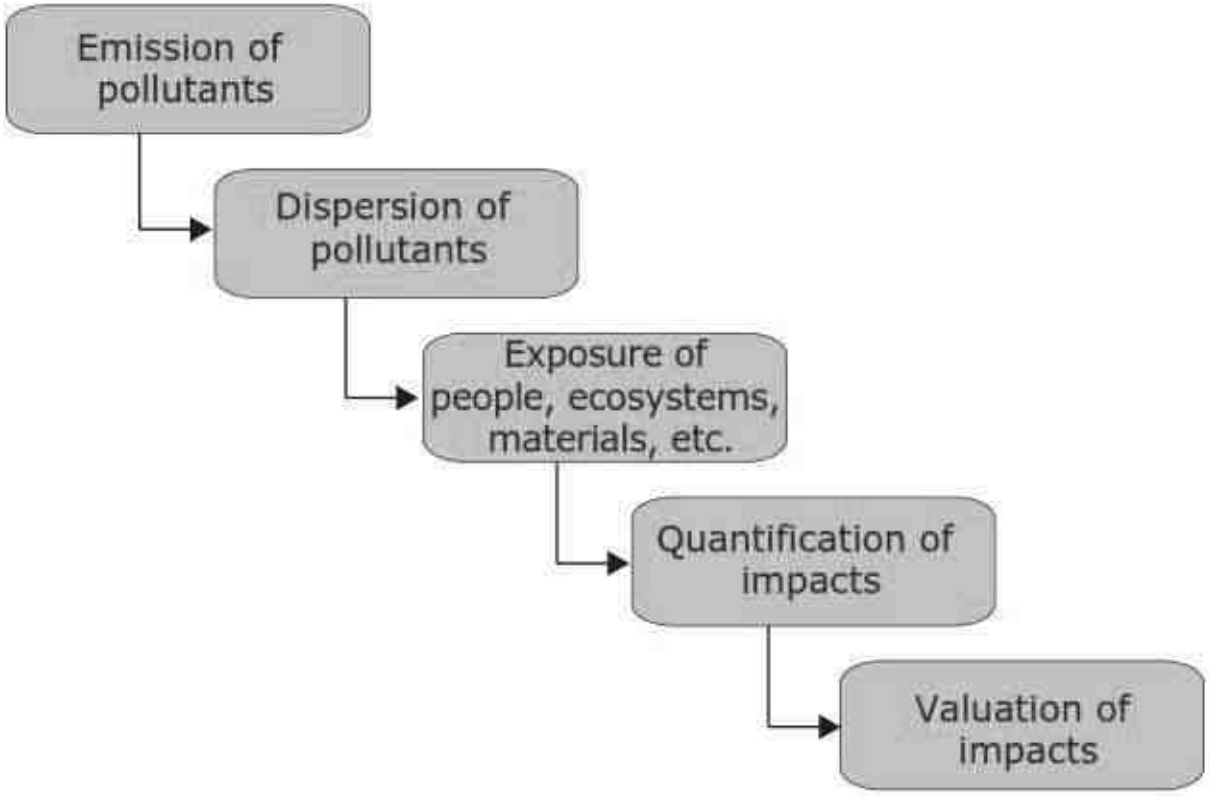


**Figure 7-2 Impact pathway methodology**

**Source:***European Environmental Agency - EEA Technical report N15/2011 ''Revealing the costs of air pollution*

**Total Damage Assessment and Cost details**

**Table 7-4 Total Damage cost of the Project for 5 Years of violation**

| S. No | Description | Cost (INR) |
|---|---|---|
| 1 | Air Environment | 9, 30,000 |
| 2 | Water Environment | 1, 01,600 |
| 3 | Noise Environment | 56,000 |
| 4 | Solid/Municipal Solid Waste | 7,308 |
| | **Total Cost** | **10,94,908** |

**Table 7-5 Existing Investment & Recurring Cost for Environmental Management Systems**

| S. No | Details | Total in Rs |
|---|---|---|
| 1 | Personal Protective Equipments | 80, 000 |
| 2 | Emergency Siren | 5000 |
| | **Total Cost** | **85, 000** |

*Total Environmental Damage Penalty – Existing Investment on EMP = Penalty for Environmental Damage*

**Table 7-10 Total Cost Details**

| S. No | Cost details | Cost (INR) |
|---|---|---|
| 1 | Total Penalty for Environmental Damage | 10, 94,908 |
| 2 | Natural Augmentation & Remediation Plan | 3, 00, 000 |
| 3 | Community Augmentation & Remediation Plan | 2, 00,000 |
| | **Total Cost** | **15,94,908** |

”,

**Table 7-11 Nature & Ecological Damage due to mining Activities & Remediation Plan and Cost**

| S. No | Parameter | Activity / Source | Impact | Cause | Remediation Plan | Cost/year in INR |
|---|---|---|---|---|---|---|
| **1** | **Air Environment** | i) Drilling<br><br>ii)Blasting<br><br>c) Movement of Machineries<br><br>d) Transportation | • Dust generation | • Particulate matter smaller than 10 microns, can settle in the bronchi and lungs and cause health problems likeBronchitis, Emphysema, Bronchial Asthma, Irritation of mucus Membranes of eyes, etc.<br>• Particles smaller than 2.5 micrometers (PM2.5), tend to penetrate into the lungs and very Small particles (< 100 nanometers) may pass through the lungs to affect other organs.<br>Vehicle emission can also create various health problems on human being. | • Using inbuilt dust collector system<br>• Usage of sharp drill bits for drilling of holes.<br>• Provision of dust filters / mask to workers working at highly dust prone and affected areas.<br>• Proper maintenance of machineries which avoids excessive noise and vibration.<br>• Sufficient training to operators on safety and environmental parameters.<br>• Regular wetting of transport road using water tanker.<br>• Avoiding overloading of tippers<br>• Covering of loaded tippers with tarpaulins during transportation.<br>• Development of green belt / barriers wherever possible. | 50,000 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **2** | **Water Environment** | a) Water usage<br><br>b) Quarry working faces and dumps | • Generation domestic Effluents.<br>• Soil erosion, siltation due to runoff / Storm Water.<br>• Reduction in ground water Siltation on rainwater<br>• drainage channel near the mine lease | • The direct impact on human beings due to poor water quality can lead to various waterborne diseaseslikediarrhoea, jaundice, dysenteryetc.<br>• Polluted water may not be useful for human or animal consumption etc., if not treated to standards. | • Rain water harvesting ponds will develop.<br>• Clear supernatant water after settling can be let out of this pond after passing through settling traps.<br>• Most of the mine water will be used for green belt, dust suppression, etc.<br>• Plantation will be carried out in the safety zone area, all possible area within the lease area<br>• Mine sump water can also be utilized. | 50000 |
| **3** | **Soil Environment** | Quarrying and dumping of waste | • Loss of top soil<br>• Loss of soil fertility & soil quality | • Affecting bioticenvironment | • The top soil will be used for afforestation &Reclamation purpose.<br>• Application of manure to retain its fertility.<br>• Spreading over reclaimed areas for plantation. | 30000 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **4** | **Noise Environment** | a)Drilling<br>b)Movement of vehicles | • Prolonged exposure to high noise level is harmful to human auditory system | • Mental fatigue<br>• Rebellious attitude<br>• Annoyance<br>• Carelessness<br>• Hearing impairment | • Providing in-built mechanism for reducing soundemissions<br>• Providing earplugs/earmuffs to workers exposed to high noisy areas.<br>• Proper and regular maintenance of equipment.<br>• Planting of trees where ever possible to act as acoustic barriers.<br>• Conducting regular healthcheckup of workers<br>• Including audiometric test for the workers engaged in noise prone area. | 50000 |
| **5** | **Vibration** | Drilling in Quarry | • Creation of Vibration effect | • Accident and injury damage to the nearby structures if appropriate technology and control measures are not adopted | • Controlling Blasting methods | 30000 |
| **6** | **Biological Environment** | Quarrying and allied operation | • Clearance of vegetation<br>• Dust generation | • Loss of vegetative cover<br>Retardation of tree growth, Tip burning | • Water sprinkling to arrest dust generation<br>• Creation of green belt in all possible vacant places within the lease area.<br>• Local species in consultationwith the state forest department can be chosen for this purpose. | 40000 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **7** | **Occupational health** | Quarrying and allied operation | • Dust generation. Noise and vibration effect | • Dust related pneumonia<br>• Tuberculosis Rheumatic arthritis Segmental vibration Miner‟sNystagamus<br>• Loss of life /machinery | • Water sprinkling on haul roads.<br>• Green belt creation wherever possible to arrest dust and reduce noise propagation.<br>• Good control measures for reducing air pollution & Control of noise levels.<br>• Conducting Initial Medical examination (IME) at pre-entry level stage of workers by qualified doctors, as per DGMS circulars.<br>• Providing Health report to employees regularly after health checkups.<br>• Provided Personnel Protective Equipments (PPE) to all staff and workers to guard against excess noise levels, dust generation and inhalation, etc., as per standards prescribed by DGMS.<br>• Imparting Vocational training to all workers/ staff. | 50000 |
| **Total cost proposed under Nature & Ecological Remediation plan is Rs. 3,00,000/-** | | | | | | |

### 7.1.5 Natural & Ecological Resource Augmentation Plan

**Natural & Ecological Resource Augmentation Plan& Mitigation measures for quarry operations for the damages caused are as below:**

**Table 7-12 Natural & Ecological Resource Augmentation Plan & Mitigation measures**

| S. No | Description | Augmentation Plan |
|---|---|---|
| 1 | Air Management | 1. Plantation along the haul roadside to reduce effects of air/ noise pollution as part of landscape development.<br>2. A row of trees to be planted along the Quarry boundary periphery to screen the site from air/ noise pollution.<br>3. Regular maintenance and upkeep of the internal roads within project site will help to reduce air pollution.<br>4. The entry/ exit to the site to be with adequate curvature so that vehicles coming out/ entering the quarry do not impinge on road traffic directly. |
| 2 | Water Management | 1. There is no effluent generation in existing quarry.<br>2. Storm water drainage system laid considering natural gradient of the site and sufficient number of recharge pits will be provided at appropriate locations to recharge ground water table.<br>3. Existing sewage disposed in to Septic tank followed by Soak pit.<br>4. Proper provision for maintenance of sewage disposal. |
| 3 | Noise & Vibration Management | 1. During quarry operations important to maintain the noise levels within the site for the safety and better health of residents in the nearby area.<br>2. The various precautions to be taken to maintain acceptable noise level within the project area are as under smooth flow of traffic to be ensured on the internal roads to avoid idling of vehicles while transportation. |
| 4 | Solid Waste Management | 1. Collection of waste, segregation, and disposal in a manner so as to cause minimal environment impact.<br>2. Non-degradable waste will be disposed to municipal garbage collection site. |
| 5 | Green Area Development Management | 1. In order to keep a check on noise levels, particulate matter dispersion and concentration of polluting agents, a green belt is provided as part of the landscaping and it shall be maintained.<br>2. There shall be monitory provision made for development of green belt.<br>3. A horticulture officer and gardener shall be appointed for the same.<br>4. Maintenance shall include watering and manuring plants at appropriate time, weeding out unwanted plants, cleaning, replacing wilted/died plants etc. |

| | | |
|---|---|---|
| **6** | Fire & Safety Management | 1. For safety purpose of the occupants a well designed disaster management plan is prepared.<br>2. Emergency Assembly points will be marked. Regular mock drill to be undertaken.<br>3. Guidance over public address systems.<br>4. Sprinklers in quarry area and common areas. |
| **7** | Energy Conservation Measures | Following non-conventional energy technologies to reduce the overall energy consumption will be adopted<br>1. Using LED/CFL lights and energy efficient fixtures<br>2. Using energy efficient motors.<br>3. Using ISI rating motors with 60% efficiency water pumps.<br>4. Using ISI rating motors with 75% efficiency motors.<br>5. Energy metering system for internal and external light.<br>6. Use of automatic sprinkler system for garden area. |

### 7.1.6 Community Augmentation Plan breakup

Project Proponent Proposed Rs.2,00,000 for Natural &Community Augmentation Plan as below:

**Table 7-13 Community Augmentation Plan**

| S. No. | Description of Beneficiary | Priority ranking for investment | Suggested % of Allocation out of Total Budget | Period (Financial Period) |
|---|---|---|---|---|
| 1 | **Education** | | 30% | 2023-2024 |
| | Providing Note books & Supply of Furniture | 2 | | |
| | Additional class rooms to Schools | 3 | | |
| | Construction Toilets | 1 | | |
| 2 | **Village Level Infrastructure** | | 35% | 2024-2025 |
| | Sanitation Household toilets | 1 | | |
| | Construction of Community Hall | 3 | | |
| | Better road facility | 4 | | |
| | HEALTH –Sub health centers & health camps | 2 | | |
| 3 | **Youth Development** | | 15% | 2025-2026 |
| | Youth motivation programmes | 1 | | |
| | Skill Training programmes | 2 | | |
| | Sports Equipments | 3 | | |
| 4 | **Environment Sustainable Development** | | 20% | 2026-2027 |
| | Tree plantation | 2 | | |
| | Agriculture, Horticulture, Animal Husbandry support programmes | 1 | | |
| | Rain water harvesting and water shed programmes in village | 3 | | |

## 7.2 Risk Identification & Management

### 7.2.1 Introduction

Mining and allied activities are associated with several potential hazards both to the employees and the public at large. A worker in a mine should be able to work under conditions that are adequately safe and healthy. At the same time the environmental conditions should be such as not to impair his working efficiency. The various safeguards to be taken to ensure the safety of the mine and that of employees are provided in the Mines Act, 1952.Risk involves the occurrence or potential occurrence of some accidents consisting of an event or sequence of events. The risk assessment study covers the following:

- Identification of potential hazard areas

- Identification of representative failure cases
- Visualization of the resulting scenarios in terms of fire (thermal radiation) and explosion
- Assess the overall damage potential of the identified hazardous events and the
- impact zones from the accidental scenarios
- Assess the overall suitability of the site from hazard minimization and disaster mitigation point of view
- Furnish specific recommendations on the minimization of the worst accident Possibilities
- Preparation of broad DMP, On-site and Off-site Emergency Plan, which includes
- Occupational Health and Safety Plan.

The complete mining will be carried out under the management control and direction of a qualified mine manager holding a first class manager's certificate of competency. Moreover, mining staff will be sent to refresher courses from time to time to keep them alert. However, following natural/industrial hazards may occur during normal operation:

- Accident due to explosives
- Accident due to heavy mining equipment; and
- In order to take care of above hazard/disasters, the following control measures will be adopted.
- All safety precautions and provisions of the Mine Act, 1952, the MMR 1961 and the Mines Rules, 1955 will be strictly followed during all mining operations
- Entry of unauthorized persons will be prohibited
- Fire fighting and first-aid provisions in the mines office complex and mining area;
- Provisions of all the safety appliances such as safety boot, helmets, goggles etc. will be made available to the employees and regular check for their use
- Training and refresher courses for all the employees working in hazardous premises; Under mines rules all employees of mines will have to undergo the training at a regular interval
- Working of mine, as per approved plans and regularly updating the mine plans;
- Cleaning of mine faces will be regularly done
- Handling of explosives, charging and blasting will be carried out by competent persons only.
- Provision of magazine at a safe place with fencing and necessary securityarrangement
- Regular maintenance and testing of all mining equipment as per manufacturer's guidelines.
- Suppression of dust on the haulage roads
- Adequate safety equipment will be provided at explosive magazine
- Increasing the awareness of safety and disaster through competitions, posters and other similar drives.

- For any type of above disaster, a rescue team will be formed by training the mining staff with specialized training.

### 7.2.2 Identification of Hazards in Open Cast Mining

There are various factors, which can cause disaster in the mines. These hazards are as follows:

- Drilling
- Blasting
- Overburden handling
- Heavy Machinery

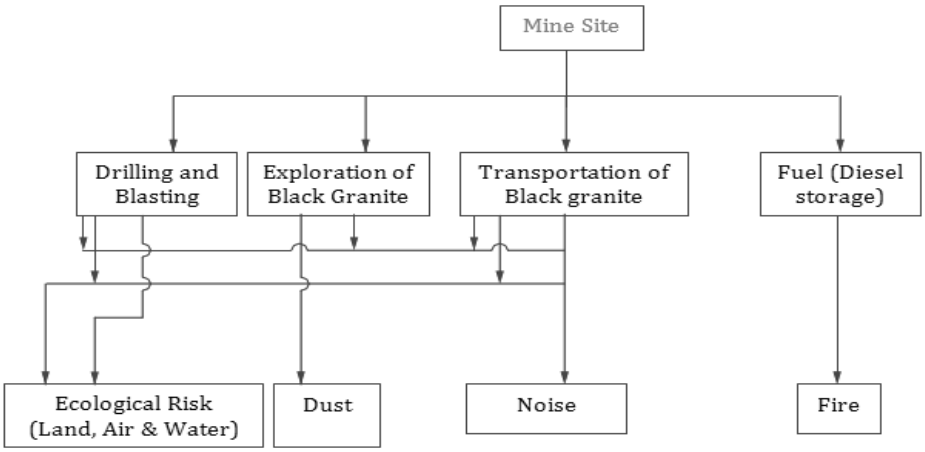


**Figure 7-3 Identification of Hazards in Opencast Mine**

**Drilling**

Drilling is an important activity in mining. This activity releases particulate matter into the air and noise in the vicinity of the operation. The particulate matter/dust can be arrested by employing dust extractor, wet or dry type. The usage of standard drill bits also reduces the dust formation. The noise is also arrested by the usage of dust extractors. The compressors which feed the compressor air to the drilling jack hammers can be covered in acoustic enclosures which reduce the dust and noise.

The hard strata will be excavated after drilling and blasting. Drilling will be done with jack hammers up to 1.2 to 1.5 m depth having a diameter of 30-32 mm.

**Blasting**

Most of the accidents from blasting occur due to the projectiles, as they may sometimes go even beyond the danger zone, mainly due to overcharging of the shot-holes as a result of certain special features of the local ground. Flying rocks are encountered during initial and final blasting operations. Vibrations also lead to displacement of adjoining areas. Dust and noise are also problems commonly encountered during blasting operations.

- The damaging impacts on environment are evident noise, gas, flyrock and ground vibration.
- The last factor is most important for safety of constructions, buildings and various natural objects in the vicinity of mining area.

- The ground vibration parameters, crucial for safety of endangered objects have a significant correlation with charge weight and distance of blasting.
- This study tried to associate the main vibration parameter, particle velocity with blasting parameters and properties of vibration medium.

**Precautionary Measures to Avoid Accidents Due to Blasting**

- The provisions laid down in the MMR 1961 related to Blasting shall strictly be followed. However some of the main provisions are written here
- The blasting will be done under supervision of blaster/mine mate/mine foreman/mine manager
- Shots shall not be fired except during the hours of daylight.
- The holes charged onany particular day shall be fired on the same day.
- Adequate blasting shelters or other protection shall be provided at mines.
- The shot-firer shall give sufficient warning by effective signals over the entire area falling within a radius of danger zone.
- Multi-shot exploder shall be used. A shot-firer will fire maximum 120 Shots.
- During the approach and progress of electrical storm, adequate precautions shall be taken.

**Overburden Handling**

No overburden will be generated in the proposed project and side burden dump may cause landslides. High side burden dump created at the quarry edge may cause sliding of the side burden dump or may cause failure of the pit slope due to excessive loading, thereby causing loss of life and property.

Heavy Machinery

Most of the accidents during transport of dumpers, trucks, proclaim, ripper dozers and other heavy vehicles are often attributable to mechanical failures and human errors.

Precautionary Measures to Prevent Accidents due to Trucks and Dumpers

- All transportation within the main working shall be carried out directly under the supervision and control of the management.
- The vehicles must be maintained in good conditions and checked thoroughly at least once a week by the competent person authorized for the purpose by the Management.
- Road signs shall be provided at each and every turning point especially for theguidance of the drivers.
- To avoid danger while reversing of vehicles especially at the embankment and tipping points, all areas for reversing of lorries should as far as possible be made man free.A statutory provision of the fences, constant education, training etc. will go a longway in reducing the incidents of such accidents.
- Generally, oversize rocks shall be dealt with in the pit by secondary blasting.
- A Load consisting of large rocks must not be over the edge.This is unsafe andmay damage equipment.

- The movement of the dumpers will be governed under the Code of Traffic rule, this is already formulated & implemented.

**Storage of Explosives**

The explosive requirement of the quarry operation is minimal. The blasting requirement will be carried out using contractors approved by the Controller of Explosives. No Explosive storage is envisaged in this quarry.

**Safety Measures at the Mine site**

- Adequate care has been taken in deciding the size of the bench for the working pit.
- The benches are properly sloped at an angle of 70 degree to avoid any spillage of benches.
- Adequate drainage system at the top of the pit and also on the benches shall be made to prevent erosion of the benches.
- The quarries will be protected by garland drains around the periphery for stormwater drainage.

## 7.3 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. For effective implementation of the disaster management plan, it should be widely circulated and personnel training through rehearsals/drills. The objective of the disaster management plan is to make use of the combined resources of the mining operation and the outside services to achieve the following:

- Effect the rescue and medical treatment of casualties
- Safeguard other people
- Minimize damage to property and the environment
- Initially contain and ultimately bring the incident under control
- Identify any dead
- Provide for the needs of relatives
- Provide authoritative information to the news media
- Secure the safe rehabilitation of affected area
- Preserve relevant records and equipment for the subsequent inquiry into the cause and circumstances of the emergency
- In effect, it is to optimize operational efficiency to rescue rehabilitation and render medical help and to restore normalcy.

### 7.3.1 Emergency Organization (EO)

It is recommended to setup an emergency organization. A senior executive (Mine Manager) who has control over the affairs of the mine would be heading the emergency organization. He would be designated as site controller. As per the general organization chart, in the mines, the Mines Foreman

would be designated as the Incident Controller (IC). The incident controller would be reporting to the site controller.

Emergency coordinators would be appointed who would undertake the responsibilities like fire fighting, rescue, rehabilitation, transport and provide essential and support services.

### 7.3.2 Emergency Communication (EC)

Whoever notices an emergency situation such as fire, growth of fire etc. would inform his immediate superior and Emergency Control Centre (ECC). The person on duty in the emergency control centre would appraise the site controller. Site Controller verifies the situation from the incident controller of that area or the Shift In-charge and takes a decision about an impending on site emergency. This would be communicated to the entire incident controllers, emergency coordinators. Simultaneously, the emergency warning system would be activated on the instructions of the site controller.

**Emergency Coordinator - Medical, Mutual Aid, Rehabilitation, Transport and Communication**

- Organizes medical treatment to the injured and if necessary will shift the injured to nearby hospitalsMobilizes extra medical help from outside, if necessary
- Keeps a list of qualified first aiders of the factory and seek their assistance
- Maintains first aid and medical emergency requirements
- Makes sure that all safety equipment are made available to the emergency team.
- Assists Site Controller with necessary data and to coordinate the emergency activities
- Assists Site Controller in updating emergency plan, organizing mock drills
- verification of inventory of emergency facilities and furnishing report to SiteController maintains liaison with Civil Administration
- Ensure availability of canteen facilities and maintenance of rehabilitation centre
- Liaison with Site Controller/Incident ControllerEnsure transportation facility
- Ensures availability of necessary cash for rescue/rehabilitation and emergency expenditure. Controls rehabilitation of affected areas on discontinuation of emergencymakes available diesel/petrol for transport vehicles engaged in emergency operation.
- He would assist Site Controller and Incident Controller
- Maintains essential services like Diesel Generator, Water, Fire Water, power supply for lighting. Gives necessary instructions regarding emergency electrical supply, isolation ofcertain sections etc. to shift in-charge and electricians
- Ensures availability of adequate quantities of protective equipment and other emergency materials, spares etc.

In order to handle disaster/emergency situations, an organization chart entrusting responsibility to various project personnel exists with their specific roles during emergency.

The possible composition of the management team shall be:

- Mines foreman
- Mine mate
- Senior most operator(communication)
- Operator(Medical Coordination

### 7.3.3 Emergency Services

This includes the fire-fighting system, first aid center, etc. Alternate sources of power supply for operating fire pumps, communication with local bodies, fire brigade etc. will also be clearly identified. Adequate number of external and internal telephone connections shall be installed.

1. Fire Protection System
2. Off Site Emergency Plan

**Fire Protection System**

The fire protection system for the project maintained will consist of Portable hand appliances of suitable types/capacities for extinguishing small fires in selected mine areas, storages areas such as that of Diesel, Explosives, etc.

**Off-Site Emergency Plan**

The offsite emergency plan defining the various steps to tackle any offsite emergencies, which may affect surrounding areas of the project, has to be prepared after due finalizing discussion in this respect with local Panchayat official, Revenue officials and District Collector. As per this off site plan, in case of any off site emergencies, actions have to be promptly initiated to deal with the situation in consultation with Collector and other revenue officials.

### 7.3.4 Mine Closure Plan

Land degradation is one of the major adverse impacts of opencast mining in the form of excavated voids and also in the form of waste dumps. As per the petro genetic character, the depth persistence of the black granite body in the area is beyond the workable limits. However, it is very difficult to operate granite dimensional stone mine economically below a depth of 14m by observing the statutory of mine safety rules and regulations. Hence in the proposed mining plan, only 30m depth has been envisaged as 'Workable depth' for safe and economic mining.

However, it is proposed not to back fill the ultimate pit, in as much as quantity of reserves is available below the workable depth of 30m and there is possibility of technology up-gradation in granite mining for greater depths. The site boundaries shall be sagely fenced and used as a reservoir after mining activities are over. There is no proposal for back filling, reclamation and rehabilitation. The quarried

pits after the end of the life of lease will be fenced to prevent inherent entry of public and cattle. There is no proposal for back filling, reclamation and re habitation.

The quarry pit will be fenced to prevent inherent entry of public. The green belt development will be maintained. Drilling will be carrying out by wet drilling to control the dust into the air. Blasting will be carrying out on limited scale. Mist spray on haul road will be proposed to prevent the dust propagation into the air. The plantation will be carried out on the safety barriers to prevent Noise, besides wet drilling will be practiced to prevent dust. All the machineries will be maintained in good conditions as per RTO and TNPCB Norms to prevent Noise, Smoke and vibration. Machineries will be periodically maintained by experienced mechanic to minimize noise, smoke and ground vibration.

- A detailed final closure plan to create productive and sustainable land use of the mined area after cessation of mining operations.
- The plan must be accepted by mine owners, regulating agencies, and local communities
- Year-wise progressive reclamation plans
- A plan to protect the health and safety of the surrounding habitat
- A plan to eliminate/contain all possible sources of pollution post-mining
- A plan to conserve valuable attributes and aesthetics of the surrounding area
- A plan to minimize and overcome adverse socio-economic impacts on the people dependent on the mine after cessation of mining operations

### 7.3.5 Progressive Mine Closure Plan

The various schedules for mining activities regarding mining of granite block, waste disposal, proposed land use pattern, environmental preservation measures, disaster management plan, etc. have been fully covered in the earlier chapters in this EIA/EMP report.

Concurrent planning for various steps to be adopted for final mine closure, along with regular working schedules and systems of the mine, will facilitate to effect smooth switchover to final mine closure stages ultimately.

### 7.3.6 Water Quality Management

Average ground water table in the region indicates availability at a depth 14m from ground level. The average water level fluctuations between pre-monsoon and monsoon season is around 1.5 m and the gradient of water table normally follows the surface slope and is from west to east directions.The ground water quality in the region indicates neutral range with pH values ranging from 6.6 to 8.3. Most of the analytical results for ground and surface water showed parameter concentrations well within the permissible limits.Garland drains will be provided all along the periphery of the mining pit and along the toes of the side burden dumps. These drains will be aligned in such a way that all the surface drainage water will be carried away from the mining zone to settling tanks.The mining pit's

catchment water will be coursed to the main sump and used for dust suppression and green belt development & plantation activities.

### 7.3.7 Mines Seepage Water

The experience of mining during past three years suggests a very little, almost negligible seepage of water in the mining pit. It will be collected in a well guarded pond / sump for settling of solids. The treated water is and will be used for dust suppression on working faces, haul roads and dump surfaces.

### 7.3.8 Air Quality Management

Ambient air quality was monitored twice in a week for One (01) season (shall cover 12 weeks), i.e. during Pre-Monsoon season (June-August 2021). $PM_{10}$, $PM_{2.5}$, $SO_2$, $NO_x$, Pb, $NH_3$, $C_6H_6$, $C_{20}H_{12}$, As, Ni, were monitored. Sampling was carried out as per Central Pollution Control Board (CPCB) monitoring guidelines at each location.

The following precautions havebeenconsideredorabatementofairpollutionin theblack granite mine area:

- Water sprinkling shall be carried out at the active working faces, on all haul-roadsand the dump surfaces.
- Regular cleaning and removal of spillage black granite from haul roads and weighbridge areas.
- Proper and regular maintenance of mining equipments.
- Development of comprehensive green belt around overburden dumps to reduce fugitive dust emissions in order to create clean and healthy environment.

### 7.3.9 Solid waste Management

As is stated earlier, mining is being carried out by opencast semi-mechanized method using conventional mining equipments i.e. hydraulic excavators / shovels and dumpers combination with ancillary mining equipment like compressor, wire cutting machine, generator etc.

The mine waste in the mine includes the over lain unrecoverable boulders / rock fragments and rubbles generated as granite rejects during the production works and the waste fragments generated during development works will be utilized for forming approach road and dumping yard purposes.Adequate space has been identified within the lease applied area for dumping such waste material on barren land covered with soil. The 7.5 m safety distance as well as the defective portion of the deposit may also be used for waste dumping purpose.

### 7.3.10 Stabilization of Dump

As the waste generation in the mine includes hard rock fragments of considerable size and irregular shape with varying angularity, the waste dump will be stable on its own even at higher slopes of the sides. However, suitable variety of soil will be identified and brought from outside and used for

increasing the stability of the sides of the waste dumps and also for planting trees over the dumps in a phased manner.

### 7.3.11 Top Soil Management

Topsoil will be properly stacked at earmarked dump site with adequate measures. It will be used for growing plants along the fringes of the site roads and reclamation of external dump and backfilled area. The topsoil stockpiles will be low height and will be grassed to retain fertility. Besides these topsoil stacks there will be temporary stacks near the excavation area and area to be reclaimed which will be made use of for concurrent lying without bringing the topsoil to the soil stack near the OB dump

### 7.3.12 Disposal of Mining Machinery

Mining operations are planned to be operated using Company owned machinery. The company has its own Excavators, Mining Tippers, compressors; wire saw machine, jack hammers, and other mining equipment. These machines are complaint to the RTO conditions and CPCB conditions. Further, the company also operates a central workshop at Salem, to cater to major repairs/Rectifications of company Equipment.

These machineries are written off and disposed on completion of their normal life as per the set guidelines of the Government and TAMIN Board. The surplus machinery in working order, will be transferred to Company's other projects.

### 7.3.13 Other Infrastructure

Mine office, store room, first-aid room etc, will be provided on semi-permanent structures within the lease applied area.

### 7.3.14 Safety & Security

The water ponds developed in the reclaimed areas shall be properly fenced for safety. The water from these ponds is likely to be potable and shall used for human & cattle consumption and for agriculture purposes.

# 8 PROJECT BENEFITS

- The quarrying activities in this belt will benefit to the local people both directly 35and indirectly 20 persons.
- The direct beneficiaries will be those who get employed in the mines as skilled and unskilled workers.
- Improvement in Per Capita Income.
- The socio - Economic conditions of the village and distance will enhance due to the project, hence the project should be allowed after considering all the parameters.
- It can thus be concluded that the project is environmentally compatible, financially viable and would be in the interest of construction industry thereby indirectly benefiting the masses.

# 9 ENVIRONMENTAL COST & BENEFIT ANALYSIS

(Not recommended during scoping)

# 10 ENVIRONMENTAL MANAGEMENT PLAN

## 10.1 Environmental Management Plan

Environmental Management Plan covers the genesis of pollution, the principal sources of pollution, the nature of pollution, the proposed measures required for meeting the prevailing statutory requirements of air emissions, waste water discharge characteristics, noise levels, land use, socio economics etc for environmental management purpose in connection with the mining and quarrying related activities in the study area.

## 10.2 Emission Source Identification

The Emission sources are activities related to pits and quarries including, overburden operations, boring, drilling, conveying, washing, drying, hauling, loading and unloading stockpiles. The emission sources may be subdivided into six broad categories:

- Emissions of PM and road dust due to HEMM & Mining Tippers.
- Emissions from generators.

## 10.3 Air Quality Management

Quarrying operations are semi mechanized to mechanized, but there is involvement of labours too. Dust would be generated during the course of over burden removing, drilling, mining, hauling, handling and transportation of the material. Dust is likely to be generated from emissions of diesel vehicles such as $SO_2$, NOx etc.

### 10.3.1 Measures for dust suppression

Water will be sprinkled for suppression of air borne dust on mine haulage roads and waste dumps on regular intervals by water tankers. Drilling of blast holes of 32 mm dia will be always under wet condition to prevent flying of dust. In the unloading point of Tippers, water will be sprinkled and further the drillers are provided with respirators in accordance with mines regulations.

### 10.3.2 Emissions from Material Handling

PM emissions occur during the handling and transfer operations of material from one process to another within the facility.Open storage piles of raw material and products are generated at various points throughout the operational area.

The environmental control measures, which are being taken and proposed to control the fugitive dust released during the stone quarry production are given below:

- The working faces will be regularly wetted before carrying out the drilling and excavation.
- Dust masks will be provided to the workers especially for the drillers and for the workers working in the loading operations.

- Periodic health check up for the workers shall be done
- Plantation along approach roads and surrounding the Quarry Lease area.
- Water tankers with spraying arrangement will be used for regular water sprinkling on the haul roads to ensure effective dust suppression.

**Haulage**

- Haul road will be maintained regularly.
- Speed limits will be prescribed for transport vehicles.
- Water will be sprayed daily on the roads by using water tankers.
- Periodic maintenance of the trucks used for transport shall be done to reduce smoke emissions.
- Over loading of trucks is avoided.

### 10.4 Noise Pollution Control

In an operational mine major noise sources are operation of mine machineries, equipment & plying vehicles. Noise generation may be for an instant, intermittent or continuous periods, with low to high decibels. General noise levels generated at mines are documented as below

| Equipment | Noise Level (dB (A)) |
|---|---|
| Rotary Drills | 72-100 |
| Compressor (85$m^3$/min) | 50-55 |
| Rock buggy machine | 110-115 |
| Excavator | 75-90 |
| Diesel Tipper | 74-109 |
| Diesel Generator | 80-94 |

The management plan for controlling noise pollution is as given below.

- Reducing the drilling operations as far as possible
- Provision of earmuffs to workers working in high noise prone areas.
- Proper gradient of haul roads to reduce cumulative noise levels.
- Development of green belt all along the boundary of the mining lease area which will act as effective noise barrier.
- Use of Diamond Wire Saw machine to reduce noise.
- Restriction of blast hole drilling to only day time hours and usage of sharp drilling bits and delivery of compressed air at optimal pressure during drilling.
- Noise emanating machine such as compressors, diesel generator are enclosed in acoustic enclosure so as to reduce the noise level.

## 10.5 Water Pollution Control Measures

### 10.5.1 Surface Water

There are no major streams and rivers, which can get effected by the mining. Hence there will be no major effect on the surface water environment.

Surface water ditches or channels will be made to divert all surface drainage for agricultural purposes.

### 10.5.2 Mine Drainage Water

During the five years sheet rock will be mined. During this period of the lease, quarrying will go to the depth of 30 meters below ground level including 12m thick overburden from the present level. Mine water will be used in mechanized cutting of the blocks and for wetting purpose.The runoff from the dumps will be channelized and care will be taken.

- Mine water will be used in wet drilling process, dust suppression & green belt development
- The runoff from the dumps will be channelized and care will be taken.

## 10.6 Land Environment

Landscape will be slightly changed due to open cast quarry. There will be no land subsidence as area is made up of hard rock. Aesthetic environment will not be effected, as the quarry is located in plain terrain. Soil cover and the weathered material accounts for the Over Burden. Agriculture is seen mainly in the plains far away from the lease area. A few bushes will be cleared to facilitate mining and other related activities and there are no big trees.

- Top soil shall be used in afforestation work, as early as possible.
- A retaining wall and garland drain will be constructed all around to prevent the wash off. Landscape will be changed due to open cast quarry. There will be no land subsidence as area is made up of hard rock. Aesthetic environment will be effected.
- Soil cover and the weathered material accounts for the Over Burden
- Top soil will be removed & stored on the inner boundary of the mining lease area. To improve its quality, soil stabilizers shall be mixed and leguminous plantation will be done over these stacks.

### 10.6.1 Top soil management

Top soil will be removed in advance and stacked separately. To improve its quality, soil stabilizers shall be mixed and leguminous plantation will be done over these stacks. Top soil shall be used in afforestation work, as early as possible. A retaining wall and garland drain will be constructed all around to prevent the wash off.

## 10.7 Solid Waste Management

The solid waste that is likely to be generated during the quarry activity will be stacked along the lease barrier according to their quality and size. Irregular large size rocks of different size will be cut.The remaining waste material will be dumped at separate lease area acquired by applicant at outside the quarry lease area. This waste rock pieces will be used as road metal or building material. All the care will be taken to minimize the waste generation at the source.

- The overburden is dumped inside the mining area to stabilize slopes and reclaim low lying areas within the mine. Top Soil recovered will be used in the green belt areas on the Southern side of the lease area.
- Top Soil recovered will be used in the green belt areas on the boundary of the mine site.
- Top soil will be removed & Stored on the inner boundary of the mining lease area. To improve its quality, soil stabilizers shall be mixed and leguminous plantation will be done over these stacks.
- The solid waste that is likely to be generated during the quarry activity will be stacked along the lease barrier according to the mining plan.
- All the care will be taken to minimize the waste generation at the source.

## 10.8 Stabilization of Dumps

The dumps are mainly constituted of quarry waste with soil. It will be afforested properly to stabilize the dumps and preserve soil character. Further ends will be properly subjected to vegetation by growing some bushes and shrubs. Garland canal also will be dug around the dump.

As the waste generation in the mine includes hard rock fragments of considerable size and irregular shape with varying angularity, the waste dump will be stable on its own even at higher slopes of the sides. However suitable variety of soil will be identified and brought from outside and used for increasing the stability of the sides of the waste dumps and also for planting trees over the dumps in a phased manner.

### 10.8.1 Measures to be adopted for Solid Wastes Management

From the waste generated if any are separated and kept at the dump site. It is supplied to crushing plants and is used as road metal. The left out waste will be used for back filling the quarry which will be covered with soil added with soil conditioners and quarry will be reforested.

## 10.9 Biological Environment

As in any typical Ligneous rocks deposit, there is no tree growth on the area, but grass shrub and bushes grow sparsely. No wildlife is found in quarry Lease area. In order to minimize the impacts and to improve up on the existing eco system afforestation plan will be envisaged.

- As in any typical intrusive igneous rocks deposit, there is no tree growth on the area, but grass shrub and bushes grow sparsely.
- In order to minimize the impacts and to improve up on the existing eco system afforestation plan will be envisaged.
- No wildlife is found in quarry Lease area.

### 10.10 Granite Conservation and Development

The mining plan proposed has fully covered the aspects of granite conservation with a future plan to extend the proposed working of the mine to the full depth of the deposit. Extreme care is being taken to ensure proper supervision of quality control of the granite dimensional stone aimed at the recovery of the maximum saleable quantity / quality of granite dimensional stones suitable for full utilization of the consumers.

### 10.11 Afforestation Plan

The main aim of the plantation of the mined out areas is to stabilize the area to protect it from rain, wind erosion, improve the aesthetics and support the re-creation of bio-diversity. For this purpose mined out area will be reclaimed by backfilling and afforested at post mining stage.

- Afforestation will be taken up along the lease area.
- In the Scheme of Mining 30 plants per year is proposed to be planted for complying Afforestation program with the arrived survival rate of 50% in the south eastern portion of the lease area in the phased manner.
- Only Shrubs and bushes are seen in the quarry Lease area.

### 10.12 Occupational Health & Safety Measures

Granite stonedoes not contain any toxic elements. Further this being a mechanized mine, production is by mechanized means and waste material handling partly by mechanized way, there shall be marginal impact on air and noise qualities. Therefore, the possibilities of any health hazards are minimal.

- Awareness and planning are keys to prevention of occupational health hazards.
- Conducting air monitoring to measure worker exposures and to ensure that provided controls are adequate for protection of workers.
- Adequate respiratory protection will be provided to the workers.
- Periodic medical examinations for all workers.
- Provide workers with training that includes information about health effects, work practices, and use of protective equipments.

### 10.13 Socio-Economic Benefits

Granite Quarry project is not going to have any negative impact on the social or cultural life of the villagers in the near vicinity. The quarry activity will provide job opportunities, which will help them to develop economically.

Granite quarry will be done with the vision of leaving a positive impact on socio-economics of people living in the nearby villages. A first-aid centre to meet the basic medical needs of employees will be provided.

### 10.13.1 Employment potential

Around 35 people directly and 20 people indirectly employed including material suppliers, outside workshops, unit supported industries. Local villagers residing in the nearby villages shall be employed as semi-skilled workers.

### 10.13.2 Care and Maintenance during Temporary Discontinuance

All the provisions as per the Mines Act 1952 and Rule17 of GC & DR 1999 shall be strictly adhered during temporary discontinuation.

### 10.13.3 Safety and Security

At the end of quarry operations, the total area excavated will be fenced properly with single opening for workers engaged in closure plan work.

## 10.14 Budget for Environmental Protection

It is necessary to include the environmental cost as a part of the budgetary cost component. Total of Rs 2,05,000/- allocated for environmental protection activities. Environmental Management cost is given in **Table 10-1.**

**Table 10-1 Environmental Monitoring Cost**

| S. No | Details | Cost in Rs. |
|---|---|---|
| 1 | Afforestation | 30,000 |
| 2 | Water Sprinkling | 50,000 |
| 3 | Water Quality Test | 25,000 |
| 4 | Air Quality Test | 25,000 |
| 5 | Noise/Vibration Test | 25,000 |
| 6 | CSR Activities | 50,000 |
| | **Total** | **2, 05,000** |

## 10.15 Environment Policy of TAMIN

M/s. Tamil Nadu Minerals Ltd, believes that good safety, Health & Pollution control practices contribute to individual well-being and organization morale. Our commitment to Safety, Health and Environment stretch beyond statutory obligations and we are committed to manage and continually improve the overall safety, Health and Environmental performance.

We M/s Tamil Nadu Minerals Ltd are committed to ensure that:

- We develop safe working methods and practices, with as objective of no injuries and accidents at the work place and provide a safe work place for our employees, contractors and other who perform their duties. We shall provide adequate Health care to our employees, and create processes to reduce the adverse effect of the operations on the health of the employees.
- We provide safety appliances and continuous training in safety to our employees and contract workmen to ensure safe production and achieve the target of zero accidents. We are committed to supporting actions aimed at increase in employees' safety outside work hours.
- We protect the environment by control and prevention of pollution and promote green environment.
- We continuously evaluate and improve our conduct and carryout regular audit, analysis and studies to eliminate potential concerns and continuously improve upon our Safety, Health and Environmental standards.
- We communicate our Safety, Health and Environmental Policy to all our employees' contractors and to the public for better understanding and practice.
- Management has knowledge of relevant issues regarding Safety, Health and Environment and provides a foundation for setting objectives and targets. Management shall fulfill its responsibility to inform, educate and motivate employees and others to understand and comply with this policy and applicable laws.
- M/s. Tamil Nadu Minerals Ltd shall use its resources in order to live up to this policy and thereby promote our business.

Besides, the company has formulated well-planned and integrated Environmental policies as shown below:

M/s Tamil Nadu Minerals Ltd is committed to welfare and development needs of the society around it.

- All rules and conditions prescribed in the Indian Mines Act, Metalliferrous Mines Regulation etc., will be adopted to ensure risks-free and safe mining operations. All personal protective devices supplied to workers and staff should be used while they work in the mines and any violation in this respect will be dealt with inflict of warnings first, followed subsequently by punitive punishments including fines and ultimately dismissal, if repeated continuously.
- Any infringement / violation of any rule or unsafe mining operations should be reported to Mines Manager / Mine Foremen /Mine Mate/ Blaster who will take immediate corrective measures for avoiding major disasters. The report will ultimately reach the Board of Directors through upwardly hierarchical communicative channels from the lowest level to superior levels in quick time bound duration.

- The Agent and the Mines Manager should exercise overall control over entire mining and connected operations and all infringements / violations on any count pertaining to unsafe operations, environmental degradation, etc., should be brought to the notice of the Board of Directors. Remedial measures for such violations and deviations should be taken by the Mines Manager to avoid any hazards or disasters in the mine and nearby areas. The persons responsible for such violations will be punished through appropriate disciplinarily penal actions.
- The EC conditions and stipulations will be strictly followed by all supervisory staff of the mine, and will co-ordinate in various issues like prescribed environmental monitoring schedules, vibration monitoring studies during blasting, green belt development, management of dumps etc.
- Penal actions will be taken by the company in cases of continuous negligence resulting in violations deviations in this respect.
- A time schedule of once in 15 days for review of all operational factors as mentioned above is in force, for proper and quick corrective actions. Hierarchical System of the TAMIN is shown in **Figure 10-1.**

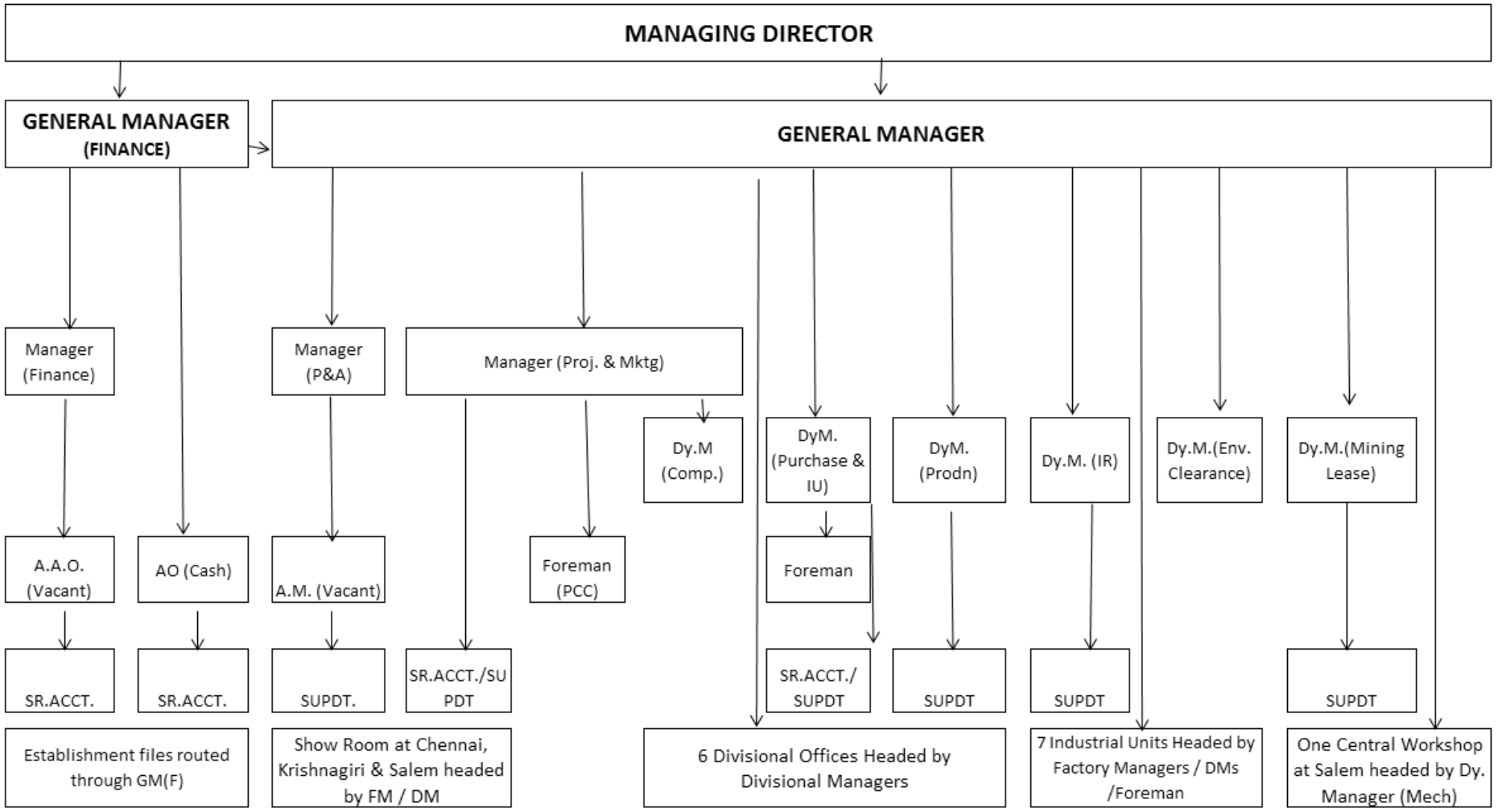


**Figure 10-1 Hierarchical System of the TAMIN**

# 11 SUMMARY & CONCLUSION

## 11.1 Background

The total extent of the quarry is 46.07.0 Ha, at S.F.No.311 (Part), Rajakkal Village, Pernambut Taluk (erstwhile Gudiyatham Taluk), Vellore District, Tamil Nadu State. Quarry Land is classified as Government Poramboke land and is lease obtained by Tamil Nadu Minerals Limited (TAMIN).

The lease area is exhibits Hilly terrain covered by massive black granite formation. Mining lease was obtained vide G.O. (3D) No. 75, Industries (MME-1) dept dated 03.09.2007 for 20 years from 17.09.2007 to 16.03.2027. Lease documents are enclosed as **Annexure –I**.

The Mining plan was approved with 10% recovery by the Commissioner of Geology & mining, Chennai vide letter No.9017/MM2/2003, dated 26.03.2004. Subsequently, TAMIN submitted the Modified Mining Plan with 10 % recovery pertaining to the years 2008-2009 to 2012-2013 over an extent of 72.44.0Ha, vide this office letter No.22700/ML2/2008, dated: 24.11.2008 and the same was approved by the Commissioner of Geology & mining Chennai,vide letter No:18349/MM5/2008,dated:10.07.2009.

Further, TAMIN submitted the scheme of Mining –II with 10% recovery pertaining for the years 2013-2014 to 2017-2018 over an extent of 72.44.0Ha vide this office letter No.15738/ML2/2013,dated:22.11.2013.

Meanwhile TAMIN submitted the surrender proposal over an extent of 26.37.0Ha from the total extent of 72.44.0Ha in S.F No. 311(part) to Government through the District collecteor, Vellore and Commisioner of Geology and Mining, Chennai vide this office Letter No. 14510/ML2/2012 dated (15.12.2012).

The proposal was appraised under violation category during 347$^{th}$ SEAC meeting held on 13.01.2023 and 592$^{nd}$ SEIAA meeting held on 16.02.2023 and recommended for violation ToR. ToR issued vide Lr. No. SEIAA-TN/F.No1652/SEACToR-1343/2023 dated 16.02.2023 for the preparation of EIA/EMP report with ecological damage assessment, remediation plan, natural resource augmentation plan and community resource augmentation plan.

TAMIN as part of the compliance from SEIAA has appointed M/s Hubert Enviro Care systems (P) Ltd, Chennai as Environmental Consultants who are accredited by National Accreditation Board for Education and Training (NABET), Quality Council of India (QCI), New Delhi.Salient Features within 15km radius of the project boundary is given in **Table-11-1.**

**Table 11-1 Project Summary & Salient Features within 15km radius of the project boundary**

| S. No | Particulars | Details |
|---|---|---|
| 1. | Latitude | 77°47'26.41"E to 77°48'6.30"E |
| 2. | Longitude | 12°0'23.59"N to 12°0'57.03"N |
| 3. | Site Elevation above MSL | ~440 m AMSL |
| 4. | Topography | Hillyterrain |
| 5. | Land use of the site | Government Poramboke land |
| 6. | Extent of lease area | 46.07.0 Ha |
| 7. | Quarry Lease (G. O.(3D)No.75) | 20 Years from 03.07.2007 to 02.07.2027 |
| 8. | Scheme of mining-1 | Letter No. 18349/MM5/2008, Dated 10.07.2009 for 72.44 .0 Ha |
| 9. | Modified Scheme of mining-II | Letter No. 15738/ML2/2013, Dated 03.11.2015 for 46.07.0 Ha |
| 10. | Modified Scheme of mining-III | Vide Rc No. 5167/MM4/2020, Dated 16.12.2020 for 46.07.0 Ha |
| 11. | | |
| 12. | Water Requirement | 25 KLD |
| 13. | Power requirement through DG Set | 60 (DG Set 1*125 kVA) |
| 14. | Fuel requirements (Lts/Day) | 200 |
| 15. | Manpower | Direct-35 & Indirect -20 |
| 16. | Municipal Solid waste Generation (Kg /day | 15.75 |
| 17. | Waste Oil generation (Lts/Y) | 3.0 |
| 18. | Project Cost in Lakh | 99.97 |
| 19. | Nearest highway | ➢ NH-48(Chennai - New Delhi) ~2.30km (SE)<br>➢ SH-130(Gudiyatham - Vaniyambadi) ~0.19km (S) |
| 20. | Nearest railway station | Pachchakuppam Railway Station ≃2.40 km (SSE) |
| 21. | Nearest airport | Tirupati International Airport 119.95 km NE |
| 22. | Nearest town / city | Nearest Town : Ambur ≃4.09km (SW)<br>Nearest City: Salem≃41.84km (SE) |
| 23. | Water bodies | |

| S.No | Water bodies | Distance (km) | Direction |
|---|---|---|---|
| 1 | Pond near Melkottakuppam | 0.22 | SE |
| 2 | Lake near Melkottakuppam | 0.23 | ESE |
| 3 | Malattar R | 1.51 | SSW |
| 4 | Palar R | 2.03 | SE |
| 5 | Chinnavarikkam Eri | 3.20 | SW |
| 6 | Tottimadugu Vanka | 3.55 | SSW |
| 7 | Anaimadugu Kanar/Periya Kanar | 4.86 | SSE |
| 8 | Uttal Vanka | 4.88 | SW |
| 9 | Seshanabail Vanka | 6.20 | SW |
| 10 | Goddar Vanka | 6.75 | NW |
| 11 | Kanjitopu Kanar/Periyakanar Aru | 7.65 | SSW |

<table>
<tr><th>S. No</th><th>Particulars</th><th colspan="4">Details</th></tr>
<tr><td></td><td></td><td colspan="4"><table>
<tr><td>12</td><td>Tungal Eru</td><td>8.27</td><td>NW</td></tr>
<tr><td>13</td><td>Utlu Vanka</td><td>9.95</td><td>WNW</td></tr>
<tr><td>14</td><td>Vellakkal Kanar</td><td>10.31</td><td>SSW</td></tr>
<tr><td>15</td><td>Godda Eru</td><td>11.06</td><td>WNW</td></tr>
<tr><td>16</td><td>Garisala Vanka</td><td>11.40</td><td>WNW</td></tr>
<tr><td>17</td><td>Ora Pallam</td><td>12.24</td><td>SSE</td></tr>
<tr><td>18</td><td>Mulamaduvu Kanar</td><td>12.33</td><td>SSW</td></tr>
<tr><td>19</td><td>Mungil Kanar</td><td>12.34</td><td>WSW</td></tr>
<tr><td>20</td><td>Bata Vanka</td><td>12.34</td><td>NW</td></tr>
<tr><td>21</td><td>kallaparai/Agaram Aru</td><td>12.50</td><td>SE</td></tr>
<tr><td>22</td><td>Dentakan Ar</td><td>12.86</td><td>SW</td></tr>
<tr><td>23</td><td>Goraluttakan Ar</td><td>12.91</td><td>WSW</td></tr>
<tr><td>24</td><td>Nalleru Vanka</td><td>14.65</td><td>N</td></tr>
<tr><td>25</td><td>Uttarakaveri Ar</td><td>14.71</td><td>ESE</td></tr>
</table></td></tr>
<tr><td>24.</td><td>Hills / valleys</td><td colspan="4">Nil in 15 km radius</td></tr>
<tr><td>25.</td><td>Archaeologically places</td><td colspan="4">Nil in 15 km radius</td></tr>
<tr><td>26.</td><td>National parks / Wildlife Sanctuaries</td><td colspan="4">Koundinya Wildlife Sanctuary ESZ ~13.18km, NW</td></tr>
<tr><td>27.</td><td>Reserved / Protected Forests</td><td colspan="4"><table>
<tr><th>S.No</th><th>Reserve Forests</th><th>Distance (km)</th><th>Direction</th></tr>
<tr><td>1</td><td>Pallalakuppam</td><td>0.64</td><td>NW</td></tr>
<tr><td>2</td><td>Sanankuppam</td><td>2.48</td><td>SSE</td></tr>
<tr><td>3</td><td>Amburdrug</td><td>4.05</td><td>W</td></tr>
<tr><td>4</td><td>Ambur</td><td>4.57</td><td>S</td></tr>
<tr><td>5</td><td>Charagallu</td><td>4.92</td><td>WNW</td></tr>
<tr><td>6</td><td>Pallalakuppam Extension</td><td>5.04</td><td>NE</td></tr>
<tr><td>7</td><td>Pallalakuppam Extension</td><td>5.69</td><td>N</td></tr>
<tr><td>8</td><td>Kempasamudram</td><td>6.30</td><td>WNW</td></tr>
<tr><td>9</td><td>Karappattu</td><td>9.39</td><td>WSW</td></tr>
<tr><td>10</td><td>Gundlapalli</td><td>9.70</td><td>N</td></tr>
<tr><td>11</td><td>Mordana Extension</td><td>10.45</td><td>NNW</td></tr>
<tr><td>12</td><td>Nayakkaneri Extension</td><td>10.98</td><td>NW</td></tr>
<tr><td>13</td><td>Karuttamalai</td><td>13.29</td><td>SE</td></tr>
</table></td></tr>
<tr><td>28.</td><td>Seismicity</td><td colspan="4">Seismic zone-III</td></tr>
<tr><td>29.</td><td>Defense Installations</td><td colspan="4">Nil within 15 km radius</td></tr>
</table>

<table>
<tr><th>S. No</th><th>Particulars</th><th>Details</th></tr>
<tr><td>30.</td><td>State Boundary</td><td>
<table>
<tr><th>S. No</th><th>State Boundary</th><th>Dist(km)</th><th>Direction</th></tr>
<tr><td>1</td><td>TN-AP State Boundary</td><td>13.18</td><td>NW</td></tr>
</table>
</td></tr>
</table>

## 11.2 Management Commitment

The company is assigning prime importance for environmental protection. The company will comply the environmental laws. The industry will maintain well developed Greenbelt. Also all the environmental statutory requirements will be implemented and maintained continually.

## 11.3 Environmental Sensitive Areas

There are no notified ecologically sensitive areas within 15km from project boundary. There is TN-AP State Boundary at ~13.18km (NW) (As per SOI Topo) from the Project boundary. Project doesn't attract the special conditions and general conditions as per EIA Notification. Project Summary & Salient Features within 15km radius of the project boundary is given in

**Table** 11-1**.**

## 11.4 Granite Quarry Reserves

The available mineable reserve calculated by deducting 7.5m safety distance and bench loss. The updated geological reserves of black granite estimated based on the geological cross-sections was 1,33,62,730$m^3$ as on 31.03.2018 by applying 25% recovery the updated effective reserves works out 33,40,683 $m^3$ as on 31.03.2018.

The Updated mineable reserves of colour granite have been computed based on the conceptual plan and sections (Plate No. 6 and 6a) upto economically workable average depth of 30m from the top surface of the granite body. The updated mineable reserves works out to 1,14,57,100 $m^3$ as on 31.03.2018. By applying 25% recovery the updated effective mineable reserves works out 28,64,65 $m^3$ as on 31.03.2018

**Table 11-2 Updated Geological reserves as on 31.03.2018**

| Section | Measurements (m) | | | ROM ($m^3$) | Effective Reserves ($m^3$) | Granite waste ($m^3$) |
|---|---|---|---|---|---|---|
| | Length | Width | Depth | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| PQ-AB | 143.00 | 513.00 | 30.00 | 22,00,770 | | |
| PQ-CD | 143.00 | 742.00 | 30.00 | 31,83,180 | | |
| QR-EF | 143.00 | 736.00 | 30.00 | 31,57,440 | | |
| RS-GH | 143.00 | 690.00 | 30.00 | 29,60,100 | | |
| ST-JK | 143.00 | 453.00 | 30.00 | 19,43,370 | | |
| **Total Geological Reserves** | | | | **1,34,44,860** | | |
| (-)Past working upto 31.03.2018 | | | | (-) 82,130 | | |
| **Updated Geological Reserves as on 31.03.2018** | | | | **1,33,62,730** | **33,40,683@25%** | **1,00,22,047@75%** |

**Table 11-3 Updated Mineable reserves as on 31.03.2018**

| **Bench** | **Measurements (m)** | | | **ROM ($m^3$)** | **Saleable Reserves ($m^3$)** | **Granite waste ($m^3$)** |
|---|---|---|---|---|---|---|
| | **Length** | **width** | **Depth** | | | |
| PQ-AB & CD, EF, GH, JK | | | | | | |
| I$^{st}$Bench | 695.00 | 577.00 | 10.00 | 40,10,150 | | |
| II$^{nd}$Bench | 683.00 | 623.00 | 10.00 | 38,45,290 | | |
| III$^{rd}$Bench | 671.00 | 549.00 | 10.00 | 36,83,790 | | |
| **Total** | | | | **1,15,39,230** | | |
| (-)Past working upto31.03.2018 | | | | (-) 82,130 | | |
| **Updated Geological Reserves as on 31.03.2016** | | | | **1,14,57,715** | **28,64,429@25%** | **85,93,286@75%** |

## 11.5 Summary of the Magnitude of Operation

The colour granite mine is over an extent of 46.07.0 ha located in S.F.No.311 (Part), located at Rajakkal Village, Pernambut Taluk (erstwhile Gudiyatham Taluk),, Vellore District, lies in the

latitude of 12°50'28.48" N to 12°50'54.66" N and longitude of 78°44'28.52" E to 78°44'55.84" E. The area is marked in the survey of India Topo sheet No.57L/9 and 57L/13.

The colour granite quarrying operation is proposed to carry out by opencast semi mechanized method by formation of benches. Benches are proposed with a height of 6m & width bench not less than the height. Proposed production of mine is 18,132$m^3$ with a depth of Mining of 30m from the top of the hillock for the period of 20 years. The area applied for quarry lease is exhibits hillyterrain; the altitude of the area is ~440 AMSL.Yearwise Development/Production for the five year 2019-2019 to 2022-2023 is given in **Table 11-4**.

**Table 11-4 Yearwise Development/Production for the five year**

**(2018-2019 to 2022-2023)**

| S. No | Year | ROM ($m^3$) | Recovery @10% ($m^3$) | Total waste generation ($m^3$) | | | |
|---|---|---|---|---|---|---|---|
| | | | | OB | Side Burden | Granite Rejects | Total |
| 1 | 2018-2019 | 3629 | 907 | - | - | 2722 | 2722 |
| 2 | 2019-2020 | 3625 | 906 | - | - | 2719 | 2719 |
| 3 | 2021-2022 | 3619 | 905 | - | - | 2714 | 2714 |
| 4 | 2022-2023 | 3640 | 910 | - | - | 2730 | 2730 |
| 5 | 2023-2024 | 3619 | 905 | - | - | 2714 | 2714 |
| **Total** | | **18132** | **4533** | **Nil** | **Nil** | **13599** | **13599** |

## 11.6 Categorization

The project falls under B1 Category, Schedule 1(a) Mining of Minerals as per MoEF&CC notification. The project falls under violation category due to the mining operation of the subject area without prior environmental clearance as per MoEF&CC gazette notification no. S.O.804(E) dated 14th March, 2017. Application for grant of Environmental Clearance was initially submitted online at SEIAA, Tamil Nadu web portal vide SEIAA-IA/TN/MIN/31357/2015, dated 29.09.2015. TAMIN commenced the mining operation of the subject area without prior Environmental Clearance under MoEF Notification dated 14.09.2006. Hence, this is a violation project. As per MoEF & CC notification dated: 14.03.2017, Form – I and feasibility report was prepared for prescribing ToR.The EC application submission under violation (Category B1, Schedule 1(a)) at TN SEIAA vide Proposal No.SIA/TN/MIN/68470/2017 & SEIAA-File.No. 1652/2017). The proposal was appraised under violation category during 347th SEAC meeting held on 13.01.2023 and 592nd SEIAA meeting held on 16.02.2023 and recommended for violation ToR. ToR issued vide Lr. No. SEIAA-TN/F.No1652/SEACToR-1343/2023 dated 16.02.2023 for the preparation of EIA/EMP report with

ecological damage assessment, remediation plan, natural resource augmentation plan and community resource augmentation plan.

## 11.7 Land Requirement

The proposed Black Granite Mine is over an Extent of 46.07.0 Ha located in S.F.No.311 (Part), located at Rajakkal Village, Pernambut Taluk (erstwhile Gudiyatham Taluk), Vellore District, and Tamil Nadu State, lies in the latitude of 12°50'28.48" N to 12°50'54.66" N and longitude of 78°44'18.52" E to 78°44'55.84" E. The area is marked in the survey of India Topo sheet No.57L/9 and 57L/13. Site Elevation is above 440~m from MSL. Land use Pattern is given in **Table 11-5.**

**Table 11-5 Land use Pattern of the lease area**

| S.No | Description | Present area ( Ha) | Modified Revised Scheme of Mining-III Period in Ha | Area at the end of the quarry (Ha) | Percentage of Area(%) |
|---|---|---|---|---|---|
| 1. | Area under quarrying | 3.18.0 | 0.95..0 | 41.32.0 | 89.88 |
| 2. | Waste Dump | 1.58.5 | 0.90.5 | 2.20.0 | 4.77 |
| 3. | Infrastructure | 0.03.0 | - | 0.03.0 | 0.06 |
| 4. | Roads | 1.03.5 | - | 0.05.0 | 0.10 |
| 5. | Green belt | 2.48.5 | 0.06.5 | 2.39.0 (0.09.0 Ha above waste dump) | 5.18 |
| 6. | Unutilized | 37.75.5 | 36.33.5 | 0.08.0 | 0.17 |
| | **Total** | **46.07.0** | **37.75.5** | **46.07.0** | **100** |

## 11.8 Water Requirement

**Table 11-6 Water requirement breakup**

| S. No | Description | Water Requirement (KLD) |
|---|---|---|
| 1 | Drinking water | 0.2 |
| 2 | Flushing | 1.3 |
| 3 | Dust suppression | 10.8 |
| 4 | Green belt | 12.3 |
| | **Total** | **24.6** |

## 11.9 Power & Fuel Requirement

The Power requirement is 60kVA meet through one DG Set with a capacity of 125kVA. The Power requirement & fuel details are given in **Table 11-7.**

**Table 11-7 Power &Fuel Requirement**

| S. No | Details | Existing |
|---|---|---|
| 1 | Power requirement (kVA) | 60 |
| 2 | DG Set capacity (kVA) | 1*125 |
| 3 | Diesel ( Liters/day) | 200 |

## 11.10 Manpower

Manpower details are given in **Table 11-8.**

**Table 11-8 Man power of the quarry**

| S. No | Description | No of persons |
|---|---|---|
| 1 | Manager | 1 |
| 2 | Mine Foreman | 1 |
| 3 | Operators & Drivers | 7 |
| 4 | Chiseling workers | 26 |
| | **Total** | **35** |

## 11.11 Solid Waste Generation &Management

### 11.11.1 Municipal Solid Waste Management

**Table 11-9 Municipal Solid Waste generation & Management**

| S. No | Type | Quantity Kg/day | Disposal method |
|---|---|---|---|
| 1 | Organic | 9.45 | Municipal bin including food waste |
| 2 | Inorganic | 6.30 | TNPCB authorized recyclers |
| | **Total** | **15.75** | |

**Note:** As per CPCB guidelines: MSW per capita/day =0.45

### 11.11.2 Hazardous Waste Management

The type of hazardous waste and the quantity generated are detailed in **Table 11-10.**

**Table 11-10 Hazardous Waste Generation and Management**

| Waste Category No | Description | Quantity (L/Year) | Mode of Disposal |
|---|---|---|---|
| 5.1 | Waste Oil | 3.0 | Will be Collected in leak proof containers and disposed TNPCB Authorized Agencies for Reprocessing/Recycling |

## 11.12 Analysis of Alternatives Sites Considered

Since the proposed project is an existing Black Granite quarry. Alternate sites are not considered.

## 11.13 Project Cost

The total capital investment on the project is 99.97 Lakhs. The Capital investment of the Project is given in **Table 11-11.**

**Table 11-11 Capital Investment on the Project**

| S. No | Description of the Cost | Cost in Lakhs |
|---|---|---|
| **I.** | **Fixed Asset Cost** | |

| | | |
|---|---|---|
| 1 | Land Cost | Nil because of Govt. Land |
| | Labours Shed | 50,000/- |
| | Sanitary facilities | 50,000/- |
| | Fencing Cost | 1,25,000/- |
| | **Sub Total** | **2,25,000/-** |
| **II.** | **Operational cost** | |
| | Jack Hammers (6 nos) | 1,98,000/- |
| | Compressor (2 nos) | 19,82,000/- |
| | Diamond wire sa (1 no) | 4,87,000/- |
| | Diesel General 120KVA | 4,00,000/- |
| | Excavator (1 no). hire | 6,00,000/- |
| | Tippers (2 nos) | 58,00,000/- |
| | Drinking water facility for the labours | 50,000/- |
| | Safety kits | 50,000/- |
| | **Sub Total** | **95,67,000/-** |
| III | **EMP Cost** | |
| | Afforestation | 30,000/- |
| | Water Sprinkling | 50,000/- |
| | Water Quality Test | 25,000/- |
| | Air Quality Test | 25,000/- |
| | Noise/Vibration Test | 25,000/- |
| | CSR activities | 50,000/- |
| | **Sub Total** | 2,05,000/- |
| | **Grand Total** | **99,97,000/- ≃Rs. 1 Crore** |

## 11.14 Baseline Study

### 11.14.1 Meteorological Environment

The micro-meteorological conditions during the study period for hourly data of wind speed, wind direction and temperature were recorded at the project site. The nearest Indian Meteorological Department (IMD) station located to project site is Vellore Districti the annually determined wind direction is East.

The site specific meteorological data of study period during the study period (Mid of Jan 2023 –Mid of April 2023). Maximum temperature is 34.0$^{o}$C. Minimum temperature is 14$^{o}$C. Average Relative humidity is 52.51%. Average Wind Speed is in study period is 3.12 m/s Study period predominant wind pattern is from East.

### 11.14.2 Ambient Air Quality

The ambient air quality has been monitored at 8 locations for 12 parameters as per NAAQS, 2009 within the study area. The average baseline levels of $PM_{10}$ (31.9 µg/m³- 48.71 µg/m³), $PM_{2.5}$(22.77µg/m³ -31.66 µg/m³), $SO_2$ (9.38µg/m³ – 14.63 µg/m³), $NO_2$(19.37µg/m³ – 29.25µg/m³), CO (0.2 mg/m$^3$– 0.62 mg/m$^3$), all the parameters are well within the National Ambient Air Quality Standards for Industrial, Commercial and Residential areas at all monitoring locations during the study period.

### 11.14.3 Noise Environment

It is observed that the day equivalent and night equivalent noise levels at all locations are within prescribed CPCB standards.

- In industrial area, day time noise level was about 59.2 dB(A) and 61.8 dB(A) during night time, which is within prescribed limit by MoEF&CC (75 dB(A) Day time & 70 dB(A) Night time).
- In residential area day time noise levels varied from 51.9 dB(A) to 54.2 dB(A) and night time noise levels varied from 40.9 dB(A) to 44.2dB(A) across the sampling stations. The field observations during the study period indicates that the ambient noise levels are within the prescribed limit noise by CPCB (55 dB(A) Day time & 45 dB(A) Night time).

### 11.14.4 Water Environment

The prevailing status of water quality at 08 locations for surface water and 8 locations for ground water have been assessed during Mid of Jan 2023 to Mid of April 2023.The standard methods prescribed in IS were followed for sample collection, preservation and analysis in the laboratory for various physiochemical parameters.

### 11.14.5 Surface water quality

Water sampling results are compared with Surface water standards IS 2296:1992.

- pH in the collected surface water samples varies between 6.77 to 7.56.
- The Total Dissolved Solids range from 221.89 mg/l to 509.64 mg/l.
- The Total hardness ranges between 133.69 mg/l – 324.6 mg/l.
- BOD values varying from 6.41 to 19.3 mg/l. COD varies from 14.7 to 45.9 mg/l.
- The concentration of heavy metals like As, Cd, Cr, Pb, Mn, Hg, Ni and Se are within the limits of IS 2296:1992.

### 11.14.6 Ground Water Quality

A summary of analytical results are presented below:

- The average pH ranges from 6.55-8.21.
- In the present findings the TDS value varied from 623.54 mg/l to 801.23 mg/l for the ground water and for all samples it exceeds the acceptable limits but within permissible limits of IS 10500: 2012.The acceptable and permissible limit of TDS for drinking water is 500 mg/l and 2000 mg/l.
- The Total hardness ranges between 145.97mg/l – 327.49 mg/l for ground water and for all samples it exceeds the acceptable limit but is within permissible limits of IS 10500: 2012.
- The Total alkalinity as calcium carbonate, Magnesium and Chloride are well within the permissible limits.

- Most of the heavy metals concentrations in the study area samples are below detection limits and all are well within the limits.

### 11.14.7 Land Environment

Assessment of soil characteristics is of paramount importance since the vegetation growth, agricultural practices and production is directly related to the soil fertility and quality. Soil sampling was carried out at eight (08) locations in the study area. It is observed that,

Summary of analytical results

- The pH of the soil samples ranged from 6.8 - 8.2.
- Conductivity of the soil samples ranged from 230 – 411umhos/cm. As the EC value is less than 2000 µS/cm, the soil is found to be non-saline in nature
- Nitrogen content ranged from 177.1mg/kg to 294.2 mg/kg
- Phosphorous ranged from 98.1 mg/kg – 156.2 mg/kg
- Potassium content ranges from 45.9 mg/kg – 82.3 mg/kg.

### 11.14.8 Biological Environment

The species observed in the study area are mostly commercial crops and plantation crops and breaks were also observed throughout the semi-evergreen and moist deciduous forest types. There is no extinct flora and fauna species found in the study area.There is one Schedule-I species namely Indian Peafowl or Peacock *(Pavo Cristatus)* found within 10km study area.

### 11.14.9 Socio Economic Environment

A socio-economic study was undertaken in assessing aspects which are dealing with social and cultural conditions, and economic status in the study area. The study provides information such as demographic structure, population dynamics, infrastructure resources, and the status of human health and economic attributes like employment, per-capita income, agriculture, trade, and industrial development in the study area. The study of these characteristic helps in identification, prediction and evaluation of impacts on socio-economic and parameters of human interest due to proposed project developments. The parameters are:

- Demographic structure
- Infrastructure Facility
- Economic Status
- Health status
- Cultural attributes

**Socio Economic profile of the study area**

The Socioeconomic profile of the study area shows that the majority of people in the study area work in non-agricultural sector, however in rural area majority of the people in the rural area depends on agricultural sector. They have good educational infrastructures and the people in the study area are well connected to the educational infrastructures. The average literacy rate of the study area is 67.0%. The people in the study area are well connected to Government primary health centres and Primary health sub-centres.

## 11.15 Anticipated Environmental Impacts

### 11.15.1 Air Environment

The emissions mainly generated from the mining activities are Blasting, Drilling, Scrapping, Excavation, Loading, Unloading, and transportation etc. Machinery like compressors and jack hammers are used for Drilling. Fugitive dust control in mine is shown in **Table 11-12**.

**Table 11-12 Fugitive dust control in mine**

| S. No | Activities | Best practices |
|---|---|---|
| 1 | Drilling | ➢ Drills should be provided with dust extractors (dry or wet system) |
| 2 | Blasting | ➢ Water spray before blasting<br>➢ Water spray on blasted material prior to transportation<br>➢ Use of controlled blasting technique |
| 3 | Transportation of mined material | ➢ Covering of the trucks/dumpers to avoid spillage<br>➢ Compacted haul road<br>➢ Speed control on vehicles<br>➢ Development of a green belt of suitable width on both sides of road, which acts as wind break and traps fugitive dust |

### 11.15.2 Noise Environment

Baseline study showed that the noise levels in both Industrial area and in Residential area are slightly exceeded the limit prescribed by CPCB. The designed equipment with noise levels not exceeding beyond the requirements of Occupational Health and Safety Administration Standard will be employed.

### 11.15.3 Land Use

The quarry extent of lease area is 46.07.0 Ha. TheLand classifies as a Government poramboke land. The quarry lease was applied quarry lease vide G.O. (3D) No. No.75 Industries (MME.1 for 20 years from 03.09.2007 to 02.09.2027).

### 11.15.4 Wastewater Management

Sewage (0.27 KLD) is being sent to septic tank followed by soak pit. There is no process effluent generation in quarry project.

### 11.15.5 Biological Environment

To reduce the adverse effects on flora/fauna status that are found in project area due to deposition of dust generating from mining operations, water sprinkling and water spraying systems will be ensured in all dust prone areas to arrest dust generation.Conservation plan is provided for one Schedule-I species namely Indian Peafowl or Peacock *(Pavo Cristatus)*found within 10km study area.

### 11.15.6 Solid/ Hazardous Waste Management

Municipal Solid Wastes including food waste are being disposed to municipal bin.

### 11.15.7 Environmental Monitoring Program

A monitoring schedule with respect to Ambient Air Quality, Water & Wastewater Quality, Noise Quality as per Tamil Nadu State Pollution Control Board (TNPCB), shall be maintained.

## 11.16 Greenbelt Development

The green belt plantation programme will be continued till the end of the mining operation in the area. In framing out this programme on a sustainable and scientific base, due consultation and coordination with the forest department will be sought. The existing plantation will be developed inside the mining lease about 0.21.5ha, out of 35.99.0ha.Plants are chosen to provide aesthetic, ecological and economical value. Trees will help to arrest propagation of noise and help to lessen dust pollution due to dust arresting action.

## 11.17 Disaster Management Plan

The salient features of Disaster Management Plan include

- Emergency shutdown procedure
- Fire protection system
- Emergency safety equipment & Reporting and response to emergency
- Emergency Help from nearby industries and tie up with nearby industries

## 11.18 Corporate Environmental Responsibility

- TAMIN Rajakkal site had no Relocation and Rehabilitation.
- Most villages have benefitted mutually at Rajakkal where the mining industry has provided indirect jobs for labor and villages provide accommodation for the labor and staff.
- Supportive industries like food supply and essential shops are economic growth in the villages.
- TAMIN Provision for CER activities will be implemented as per MoEF&CC O.M dated20th October, 2020 (F.No. 22-65/2017-IA.III) are summarized as follows.

## 11.19 Benefits of the Proposed Project

- The quarrying activities in this belt will benefit to the local people directly 35persons and indirectly 20 persons.
- The direct beneficiaries will be those who get employed in the mines as skilled and unskilled workers.
- Improvement in Per Capita Income.
- The socio - Economic conditions of the village and distance will enhance due to the project, hence the project should be allowed after considering all the parameters.
- It can thus be concluded that the project is environmentally compatible, financially viable and would be in the interest of construction industry thereby indirectly benefiting the masses.

# 12 DISCLOSURE OF CONSULTANTS

In order to assess the potential environmental impacts dueto the proposed project at Survey. 311(Part), Rajakkal Village, Pernambut Taluk (erstwhile Gudiyatham Taluk), Vellore District, Tamil Nadu State to undertake EIA study.The nature of consultancy service rendered covers terrestrial environmental assessment.

## 12.1 Brief Profile of Hubert Enviro Care Systems (P) Limited (HECS)

Hubert Enviro Care Systems (P) Limited is a leading Environmental Management Company and service provider serving as a catalyst for environmental protection in the industrial & service sectors.

Enviro care Systems was started in 1997 as a proprietor company. In the year 2004, Enviro Care Systems became a Private Limited Company and registered as Hubert Enviro Care Systems (P) Limited.

Across two decades of operation we have developed into a matured corporate house to meet client's requirements to provide products and services of Global standards at the most competitive price within committed schedule of time.

We have full-fledged office and laboratory at Chennai, Mangalore, Trivandrum & Hyderabad.

## 12.2 Strengths of HECS

Number of Employees

| | |
|---|---|
| Consultancy | 42 |
| Laboratory | 100 |
| Projects | 29 |
| ]Operation & Maintenance | 999 |
| **Total No of Employees** | **1170** |

## 12.3 Quality Policy of HECS

# Hubert Enviro Care Systems (P) Ltd

HECS

## IMS POLICY

*We are committed to achieve customer satisfaction in our activities of provision of environmental services such as Project Engineering/ Consultancy / EIA services/ Laboratory and site monitoring / testing services / operations and maintenance of Pollution control systems with best quality, on time service and value for their money by*

- *Meeting the ever-changing Customer requirements and their latent expectation so as to focus on customer delight through proactive measures using latest technology and team work.*
- *Conserving resources, reducing waste generation and prevention of pollution through respecting nature*
- *Minimizing the Occupational health and safety hazards and prevention of injury and ill health at work place.*
- *Complying with all applicable legal & other requirements.*
- *Enhancing total quality in all aspects of management, environmental & safety responsiveness and Mind set among the work force.*
- *Continually improving the overall organizational performance by adopting the integrated Management system through appropriate planning, implementing and reviewing the objectives and targets and there by achieve, sustain and improve over all organizational development.*

Date: 01-02-2013

Place: Chennai

*J R Moses*

*C E O*

## 12.4 QCI-NABET - EIA Accreditation

| | |
|---|---|
| Consultancy | Hubert Enviro Care Systems Pvt. Ltd., Chennai |
| NABET Certificate No | NABET/ EIA/ 2224/ SA0190 Valid up to 27/07/2024 |
| MoEF Reg. Lab | F.No. Q-15018/13/2016-CPW |

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# National Accreditation Board for Education and Training

NABET

## Certificate of Accreditation

### Hubert Enviro Care Systems Pvt. Ltd.,

*A-21, (Behind Lions Club School) III Phase, Thiru Vi Ka Industrial Estate, Guindy, Chennai - 600 032.*

*The organization is accredited as* ***Category-A*** *under the QCI-NABET Scheme for Accreditation of EIA Consultant Organization, Version 3: for preparing EIA-EMP reports in the following Sectors –*

| S. No | Sector Description | Sector (as per) | | Cat. |
|---|---|---|---|---|
| | | NABET | MoEFCC | |
| 1 | Mining of minerals including open cast/ underground mining | 1 | 1 (a) (i) | A |
| 2 | Offshore and onshore oil and gas exploration, development & production | 2 | 1 (b) | A |
| 3 | River Valley projects | 3 | 1 (c) | A |
| 4 | Thermal power plants | 4 | 1 (d) | A |
| 5 | Mineral beneficiation | 7 | 2 (b) | A |
| 6 | Metallurgical industries (ferrous & nonferrous)- both primary & secondary | 8 | 3 (a) | B |
| 7 | Cement plant | 9 | 3 (b) | A |
| 8 | Petroleum refining industry | 10 | 4 (a) | A |
| 9 | Pesticides industry and pesticide specific intermediates(excluding formulations) | 17 | 5 (b) | A |
| 10 | Petro-chemical complexes (industries based on processing of petroleum fractions & natural gas and/or reforming to aromatics) | 18 | 5 (c) | A |
| 11 | Petrochemical based processing (processes other than cracking & reformation and not covered under the complexes | 20 | 5 (e) | A |
| 12 | Isolated storage & handling of hazardous chemicals (As per threshold planning quantity indicated in column 3 of Schedule 2 & 3 of MSIHC Rules 1989 amended 2000) | 28 | - | B |
| 13 | Synthetic organic chemicals industry | 21 | 5 (f) | A |
| 14 | Industrial estates/ parks/ complexes/ Areas, export processing zones(EPZs), Special economic zones (SEZs), Biotech parks, Leather complexes | 31 | 7 (c) | A |
| 15 | Ports, harbours, break waters and dredging | 33 | 7 (e) | A |
| 16 | Highways | 34 | 7 (f) | B |
| 17 | Common Effluent Treatment Plants (CETPs) | 36 | 7 (h) | B |
| 18 | Common municipal solid waste management facility (CMSWMF) | 37 | 7 (i) | B |
| 19 | Building and construction projects | 38 | 8 (a) | B |
| 20 | Townships and Area development projects | 39 | 8 (b) | B |

***Note: Names of approved EIA Coordinators and Functional Area Experts are mentioned in SAAC minutes dated Feb 3, 2023 posted on QCI-NABET website.***

*The Accreditation shall remain in force subject to continued compliance to the terms and conditions mentioned in QCI-NABET's letter of accreditation bearing no. QCI/NABET/ENV/23/1696 dated March 6, 2023. The accreditation needs to be renewed before the expiry date by Hubert Enviro Care Systems Pvt. Ltd, following due process of assessment*

| Sr. Director, NABET | Certificate No. | Valid up to |
|---|---|---|
| Dated: March 6, 2023 | NABET/EIA/2224/SA 0190 | July 27, 2024 |

*For the updated List of Accredited EIA Consultant Organizations with approved Sectors please refer to QCI-NABET website.*

Further details may be seen on the following URL: www.hecs.in.