

ENVIRONMENTAL MONITORING REPORT

BASED ON DATA GENERATED

FROM

APRIL – SEPTEMBER 2021



FOR

PENGUIN TRADING & AGENCIES LIMITED

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RAIKELA – TANTRA IRON ORE MINES

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1.0 INTRODUCTION

Raikela – Tantra Iron Mines of M/s Penguin Trading & Agencies Ltd. is an Iron ore mine operating since 1987 in the district of Sundargarh of Odisha State. The mining lease covering an area of 49.372 ha is located in the villages Raikela and Tantra (**Figure No: 1.1**), under Bonai sub-division of Sundargarh district. The area is approximately 100 kms from the Steel city of Rourkela by road and 10 kms from the mining town Koida. A vicinity map up to 10 kms radius from the center of the lease is given in **Figure No: 1.2**. Presently (during the period, i.e from April to September 2021) the mine has produced 4, 59, 701.502 MT of Iron ore by mechanized method of mining. As per EIA notification 2006 the mine has already received Environmental Clearance from State Environment Impact Assessment Authority (SEIAA), Odisha on 27th December, 2012 vide letter no: 354/SEIAA for production of Iron Ore up to 1.080 million ton per annum.

2.0 PRESENT STATUS OF THE PROJECT

At present from April 2021 to September 2021 the mine has produced Iron Ore of 4, 59, 701.502 MT, apart from this 4, 73, 066.520 MT of Iron ore has been dispatched to the outside parties like Steel and Sponge Iron Plants by road. During the financial year 2020-21 the mines has produced Iron Ore to the tune of 10, 78, 900 MT. The surface plan of the mines is given in **Figure No: 2.1**

The operation of the mines is being carried out in all total three no. of quarries in two sections, the Raikela section and Tantra section, Raikela section is having two quarries i.e. Raikela & Raikela West in operation. The detail bench parameters of all the quarries are as follows:

Table No. 2.1: Dimensions of Working Quarries

Quarry Name	Quarry Size (in m)			Top RL	Bottom RL	No. of Benches	Bench Size (in m)	
	L	W	D				W	H
Raikela & Tantra	666	135	131	812	681	16	12	06
Joint Mining	78	215	18	804	786	05	12	06

The present working depth of Raikela & Tantra section is between 812m to 681m AMSL. In Joint Mining Section present working depth of the pit is between 804m to 786m AMSL. The working has gone down from 812m AMSL to 681m AMSL in Raikela & Tantra section and from 804m AMSL to 786m AMSL in Joint Mining section, but it has not encountered the ground water table so far.

The project proponent has complied with the specific conditions mentioned in the environmental clearance and the status of compliance is also provided.

Figure No: 1.1 Location Map of the Project

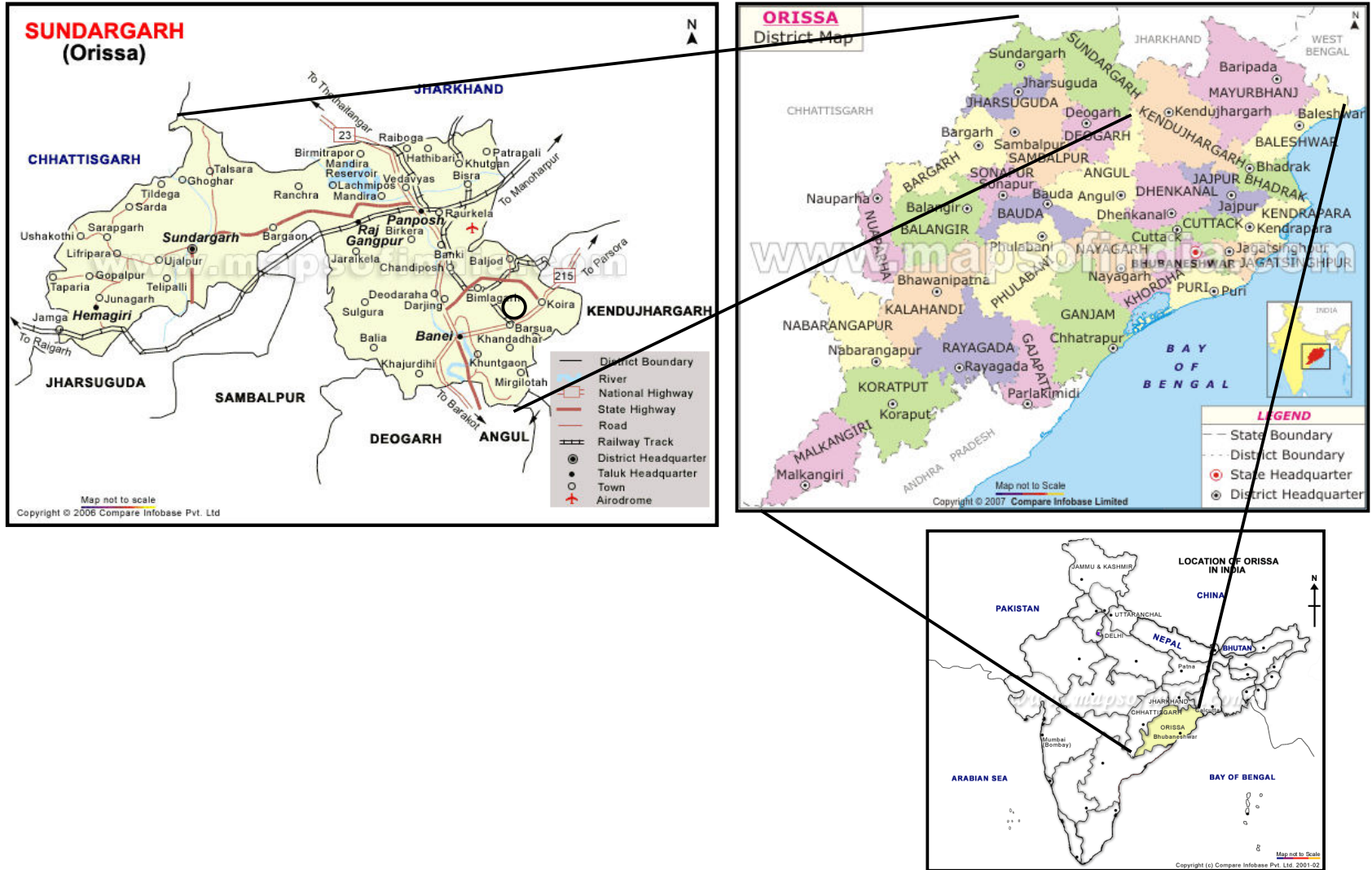


Figure No: 1.2 VICINITY MAP

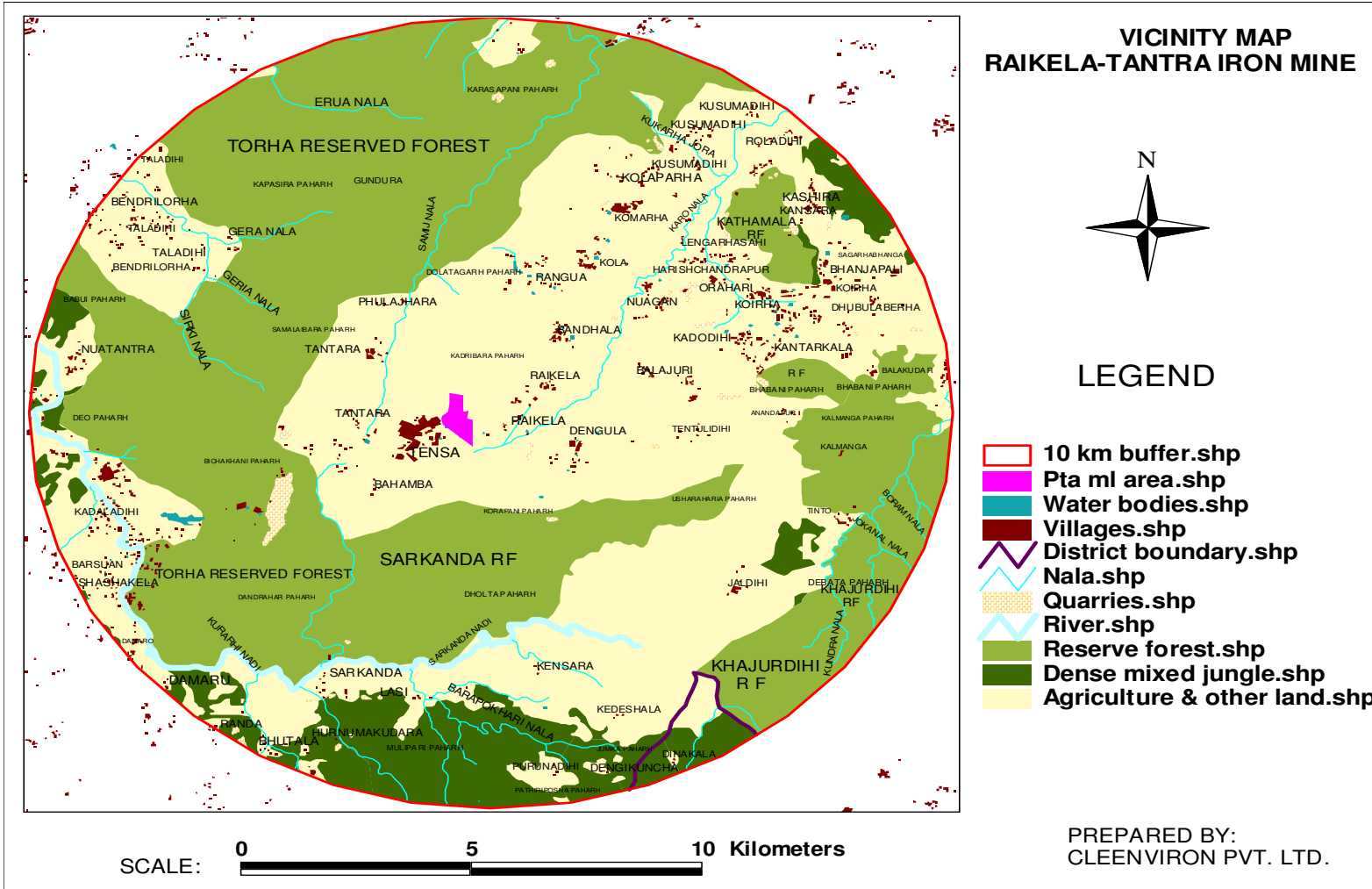
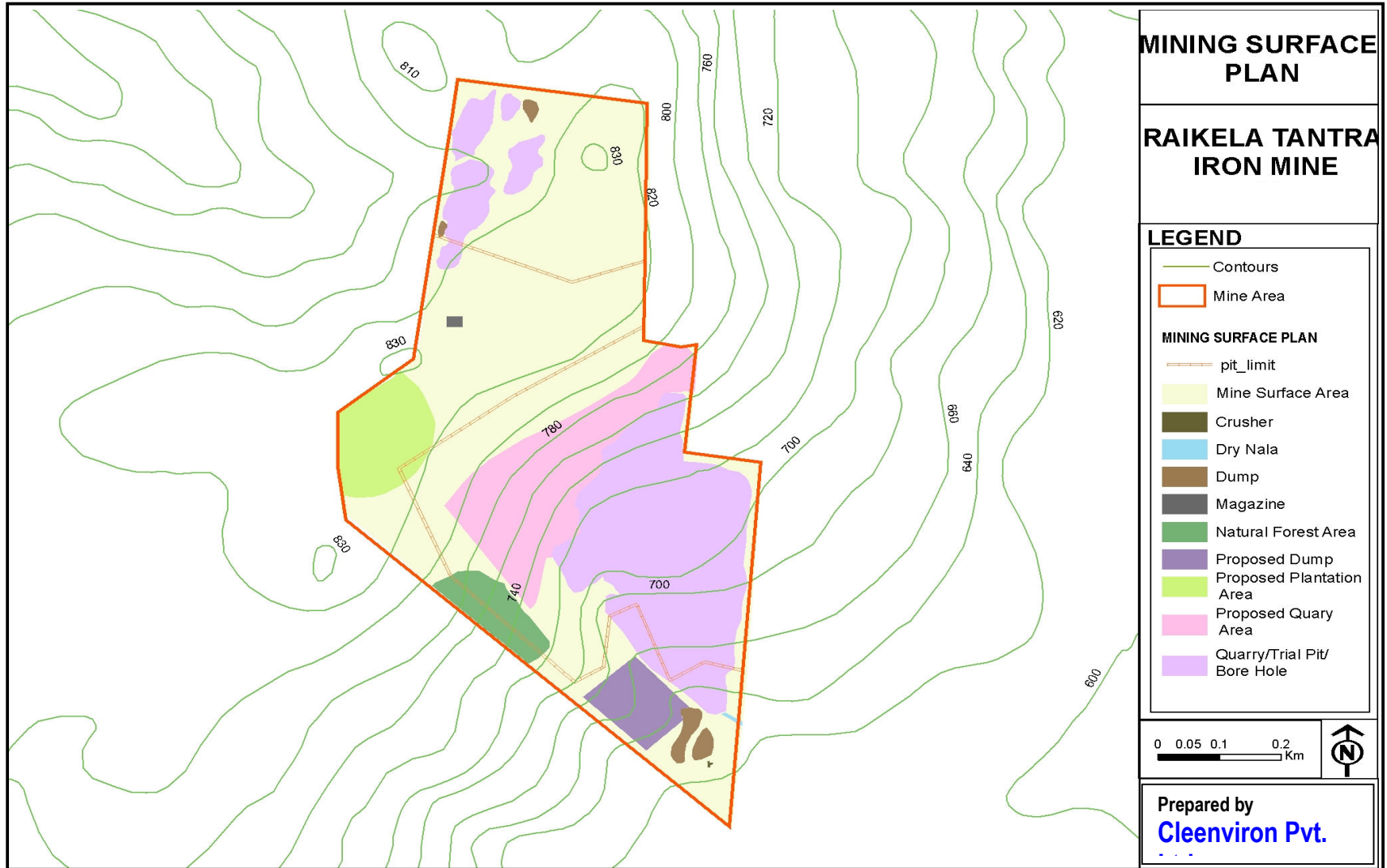


Figure No: 2.1 SURFACE PLAN OF RAIKELA – TANTRA IRON MINE



General Conditions:

1. Three continuous ambient air quality monitoring stations are fixed within the core zone and four in the buffer zone are fixed in consultation with SPCB and considering the meteorological data. Monitoring is being carried out with a frequency of once in every month at each locations of buffer zone for the parameters like PM_{2.5}, PM₁₀, SO₂, NO₂ & CO and three continuous ambient air quality monitoring stations are being operated continuously and 24 hours monitoring data are recorded.
2. Fugitive dust emission monitoring is also carried out at 5 locations within the mining lease area on twice weekly basis for the parameter Particulate Matter and data thus collected is reported.
3. The Noise level is monitored on once in a week basis in the work places and once in a month in buffer zone of the mining lease area.
4. Ground water level and quality is monitored on quarterly basis and surface water quality is monitored every month and data thus collected is reported.
5. To know the status of soil quality in and around the mining lease area, Soil samples are collected from two locations on six monthly basis and data thus collected are reported.
6. The regular monitoring is being carried out by NABL accredited Laboratory and empanelled laboratory of State Pollution Control Board, Odisha.
7. During the period of six months from April – September 2021 the project proponent has done plantation of 7000 saplings within and outside mining lease area including species like, Karanja, Neem, Teak, Amla, Ukalipotias, Gambhari, Imlee, Chakunda, Sirish, Simaruba, Sisoo, Jack-fruit, Gulmohar, Bamboo, Khaeera, Accacia SPP, Accacia Magnum, Baula, Buken, Sitafala in and around backfilled area, stabilized OB dump, safety zone as replacement & along Karo Nala, Kelabagan Pond, Raikela Pond, Dengula Devimala and Tensa Field out of which 5709 saplings have survived till date. The survival rate is found to be around 81.55%.

3.0 ASPECTS CONSIDERED FOR ENVIRONMENTAL MONITORING

This report is based on the monitoring results generated from April to September 2021 covering summer and monsoon seasons of the year. Ambient Air Quality within the buffer zone, Surface Water Quality & Noise Level monitoring also in buffer zone was carried out on monthly basis at each location. Ambient Air Quality in core zone was monitored 24 hours continuous basis and Fugitive dust emission monitoring was carried out on twice weekly basis at each locations. The Noise monitoring within core zone was also monitored weekly basis. However other aspects like, Ground Water quality, Ground Water level, Stream Flow measurement and Stack emission from DG sets are carried out on quarterly basis, i.e. during May and August months of the year. Soil quality monitoring is carried out on six monthly basis. Environmental Monitoring data were generated at Raikela & Tantra Iron Mines and its buffer zone covering the following aspects in detail.

- i. Micro-meteorological study
- ii. Ambient Air Quality Study
- iii. Fugitive Dust Emission Monitoring
- iv. Surface Water Quality Study
- v. Ground Water Quality Study
- vi. Ground Water Level Study
- vii. Soil Quality Study
- viii. Noise Level Study

Monitoring of environmental parameters for collection of data involves field work, which is described below:

3.1 Micro-meteorological Monitoring

To record the hourly meteorological data one automatic weather monitoring station has been installed within the ML area near the mines site office and parameters like, wind speed, wind direction, temperature, relative humidity and rainfall is being recorded.

3.2 Ambient Air Monitoring

As per the letter no 14257/Ind. I-Con-(Misc) 1533, Dated: 01.12.2018 from SPCB, Bhubaneswar and recommendation of CSIR – NEERI, the ambient air quality monitoring stations are fixed which are as follows. Total 3 (Three) monitoring stations are fixed within the core zone including 1 (One) at the entry and exit point of the ML area and 4 (Four) in the buffer zone. The monitoring locations are fixed according to the micro-meteorological data and in consultation with State Pollution Control Board. The monitoring was carried out for parameters like PM_{2.5}, PM₁₀, SO₂, NO₂ & CO and monitoring was carried out once in every month at each location within the buffer zone. Within core zone continuous monitoring for 24 hours is carried out in all the three locations. For collection of samples Respirable Dust sampler and Fine Particulate Sampler was placed at each locations, sampling and analytical techniques are followed as per the standard method of ambient air sampling and analysis.

3.3 Fugitive Dust Emission Monitoring

To assess fugitive dust emission level, total 5 (Five) monitoring stations are fixed in the core zone. The monitoring locations are fixed nearer to the most dust generation sites like working pits (Raikela & Tantra) of the Mine and downwind of the OB dump, Weigh Bridge and Screen Plant, within the quarry. The monitoring was carried out for parameter Particulate Matter and monitoring was carried out twice in every week at each locations. For collection of samples High Volume Sampler, Make: Envirotech Instruments Pvt. Ltd., New Delhi, Model: APM 415 was placed at each location, sampling and analytical techniques are followed as per the standard method of sampling and analysis.

3.4 Surface Water Quality Study

Total eight locations were fixed for sampling of the surface water quality from Karo River, Samij Nallah, Teherai Nallah & Kuradihi Nallah which are flowing near the ML area within the buffer zone of 10kms. The sampling and analysis of all the water bodies mentioned were carried out on monthly basis from up stream of ML area as well as downstream of ML area. The parameters analyzed are as per the surface water quality standards, IS: 2296 (Class C). Few parameters like pH, Temperature and DO are recorded at the site. For other parameters the samples were fixed and preserved as per the standard methods of sampling by APHA 23rd edition.

3.5 Ground Water Quality Study

To find out the ground water quality of the area, a net work of 5(five) existing dug wells are fixed and the sampling was carried out on quarterly basis during month of May and August, as per the environmental clearance conditions of MoEF. The parameters analyzed were as per the drinking water standards of IS 10500. Few parameters like pH and Temperature are recorded at the site. For other parameters the samples were fixed and preserved as per the standard methods of sampling by APHA 23rd edition.

3.6 Ground Water Level Study

To assess the ground water availability and fluctuation, a net work of 5 (Five) existing dug wells are fixed (from where the ground water quality study were carried out) for ground water level

measurement. To measure the ground water level piezometers are fixed at each dug wells and the variation of ground water level are being studied on quarterly basis during the months of May for summer season and August for monsoon season.

3.7 Noise Level Study

Noise monitoring were carried out at 5 (Five) different locations within the Core zone once in every week and 4 (Four) locations within the buffer zone once in every month. The measurements were done by Sound Level Meter, make: Envirotech Instruments Pvt. Ltd., New Delhi, in dB(A) at a height of 1.5 meter, above ground level and away from the sound reflecting sources like walls and buildings etc.

3.8 Soil Quality Monitoring

Soil monitoring were carried out at 2 (two) different locations, one within the Core zone and one location within the buffer zone, once in six months period during the month of May.

4.0 SAMPLING LOCATIONS

4.1 Ambient Air Quality Monitoring

Three ambient air quality monitoring station were fixed within the core zone and four stations were fixed in the buffer zone. The locations of monitoring stations are shown in the **Figure No: 4.1 & 4.2**. General precautions were taken to position the Respirable Dust Samplers at all the locations. The descriptions of the Ambient Air Monitoring Stations are as follows:

A-1 Near Mines Site Office:

The sampling station is located within the core zone to assess the present level of pollution due to the overall mining operation from both the working quarries.

A-2 Tantra Section Near Lease Boundary:

The sampling station is located within the core zone to assess the present level of pollution due to the overall mining operation from tantra section of the mines and also the emissions from the new crusher plant.

A-3 Near Main Entry Gate of the Mine:

The sampling station is located within the core zone to assess the present level of pollution due to the overall mining operation and emission of dust due to ore and overburden hauling by trucks.

A-4 Mines Office Area:

The sampling station is located nearest to the core zone (500m from the South-East ML boundary) to assess the direct effect of mining operations on the background air quality and receptors.

A-5 Village Dengula:

The location was selected outside the core zone and to assess the effect of mining and hauling of Iron Ore from the mine to outside Crusher Plants and Sponge Iron Plants on the background air quality and receptors.

A-6 Tensa Town:

This location is situated in the buffer zone of the mine and selection of this location was done as to assess the effect of the mining operation on the local receptors, as this town is falling in the predominant wind direction towards west - south-west of the lease area.

A-7 Village Bahamba:

This location is situated in the buffer zone of the mine and selection of this location was done as to assess the effect of the mining operation on the local receptors, as this village is falling in the predominant wind direction towards south-west of the lease area.

The distances and directions of the Ambient Air Quality monitoring locations are summarized below:

Table No 4.1: Ambient Air Quality Monitoring Stations

SI No	Name of Location	Zone	Distance	Direction
1	Near Mines Site Office	Core	-	-
2	Near Lease Boundary of Tantra Section	Core	-	-
3	Near Main Entry & Exit Gate of the Mine	Core	-	-
4	Mines Office Area	Buffer	500 m from ML Area	SE
5	Village Dengula	Buffer	2.5 km from ML Area	SE
6	Tensa Town	Buffer	1.3 km from ML Area	W
7	Village Bahamba	Buffer	2.6 km from ML Area	SW

4.2 Fugitive Dust Monitoring:

Five fugitive dust emission monitoring locations are established inside the core zone, to find out the amount of dust being generated from the source during the excavation, drilling & hauling of Iron Ore and overburden. The locations of the stations are shown in the **Figure No: 4.2**. The descriptions of fugitive emission monitoring locations are as follows:

F-1 Downwind of Excavator/ Drill Machine within the Quarry (Raikela Section)

This location was fixed within quarry of Raikela section and while operation of mining equipments are on. Towards the down wind direction of the whole quarry area within a distance of 25m, one high volume sampler was set for 4 hours operation and the parameter monitored is SPM general precautions are obeyed while collection of samples.

F-2 Downwind of Excavator/ Drill Machine within the Quarry (Tantra Section)

This location was fixed within quarry of Tantra section and while operation of mining equipments are on. Towards the down wind direction of the whole quarry area within a distance of 25m, one high volume sampler was set for 4 hours operation and the parameter monitored is SPM general precautions are obeyed while collection of samples.

F-3 Downwind of OB Dump Area

This location was fixed to evaluate the amount of pollution load on the ambient air due to moving of heavy earth moving equipments like Dozer, Dumpers etc. The sampler was being operated for continuous of 4 hours at the downwind of OB dump at a distance of 25m from the dump and parameter like SPM is measured.

F-4 Downwind of Weigh Bridge

This location was fixed to evaluate the amount of pollution load on the ambient air due to moving of loaded Dumpers for weighing. The sampler was being operated for continuous of 4 hours at the downwind direction at a distance of 25m from the weigh bridge and parameter like SPM is measured.

F-5 Downwind of Screen Plant

This location was fixed to evaluate the amount of pollution load on the ambient air due to screening operation of Iron Ore and excavated ROM. The sampler was being operated for continuous of 4 hours at the downwind direction at a distance of 25m from the Screen Plant and parameter like SPM is measured.

Figure No: 4.1 AMBIENT AIR MONITORING LOCATIONS IN BUFFER ZONE

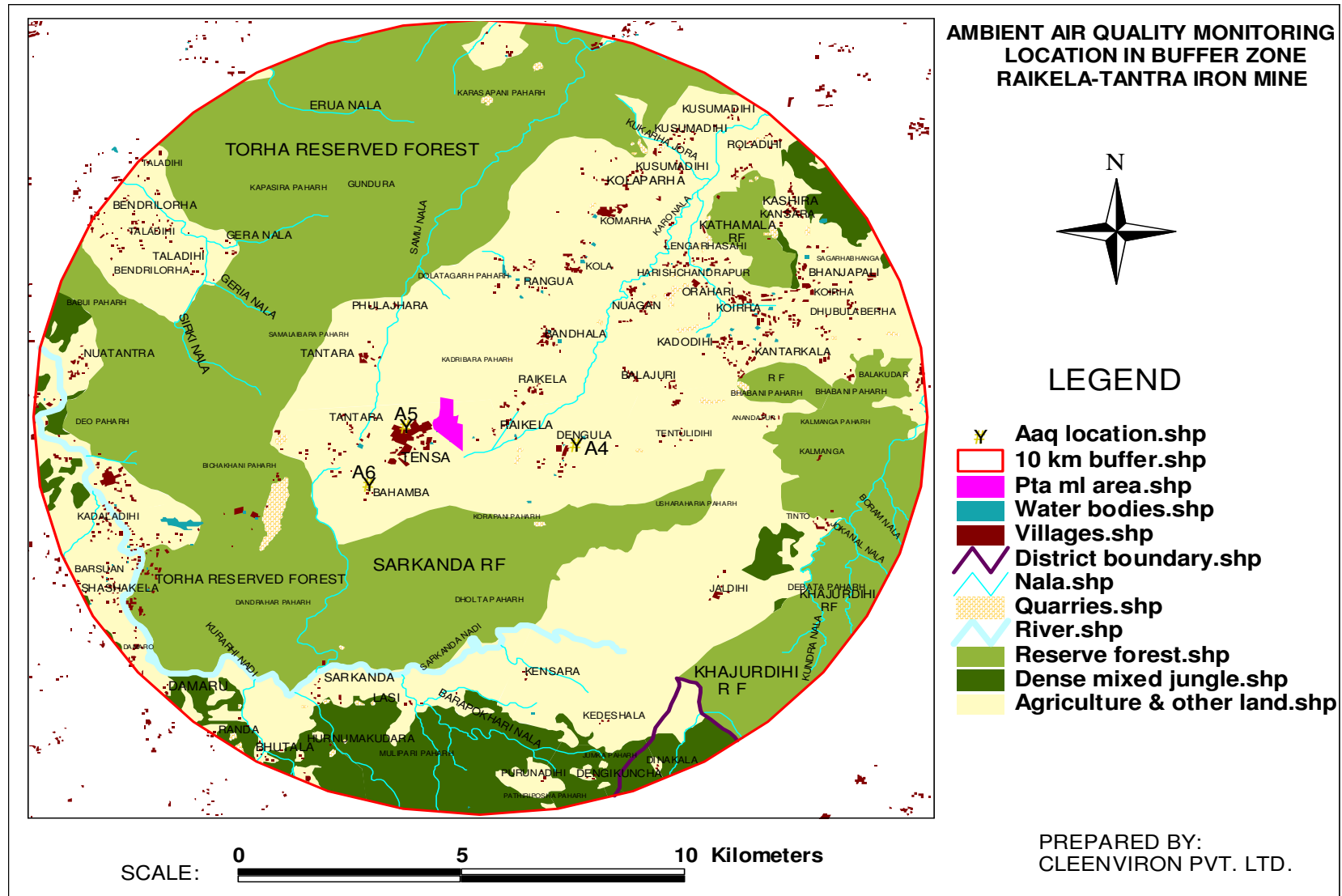
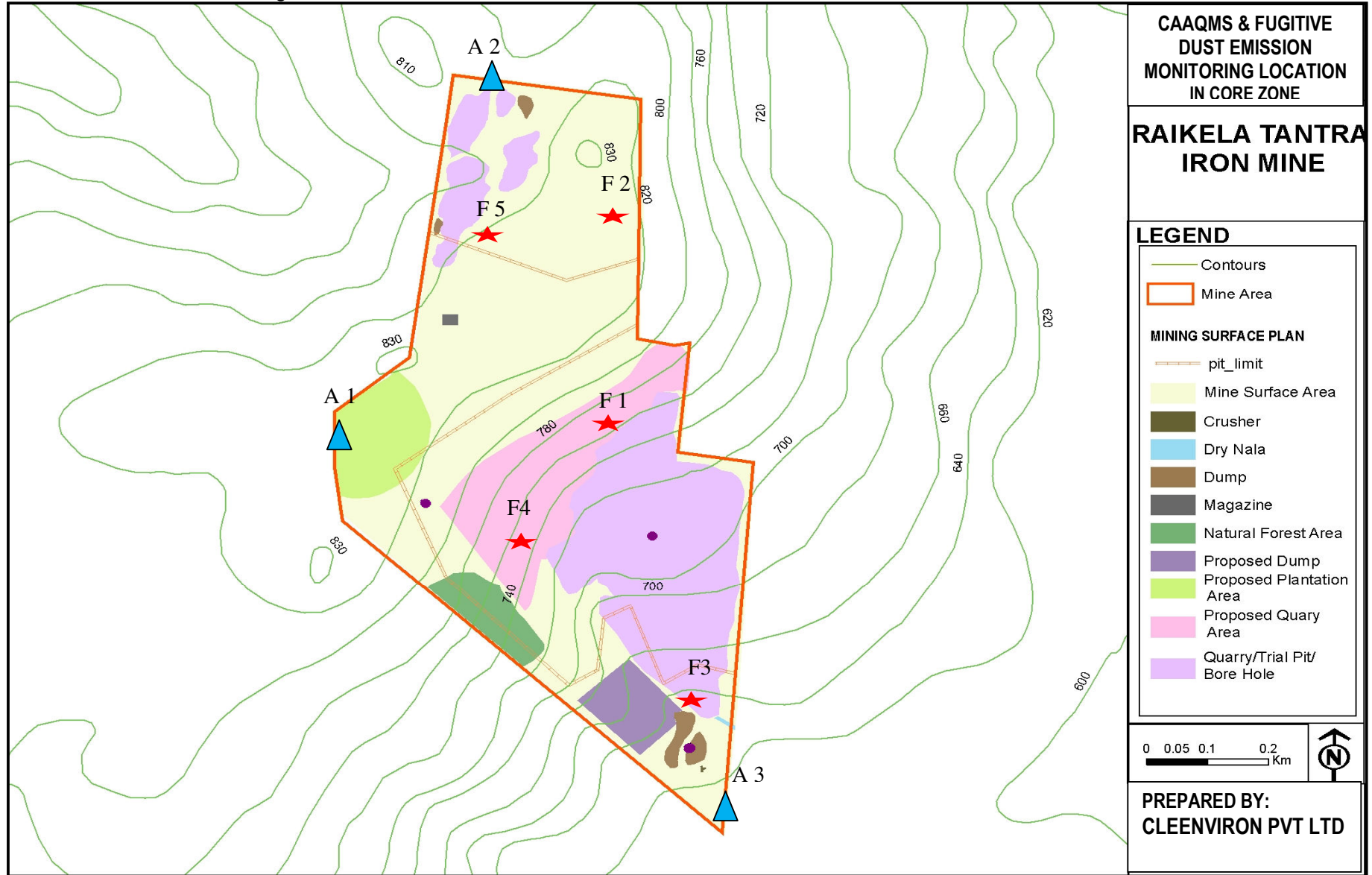


Figure No: 4.2 CAAQMS & FUGITIVE DUST EMISSION MONITORING LOCATIONS IN CORE ZONE



4.3 Surface Water Quality:

In order to assess the quality of water from the surface water bodies mentioned due to the mining activity. Two sampling locations were set one at 100 m up-stream of ML area and second at 100 m downstream of ML area on each of the water bodies, the locations of sampling are shown in the **Figure No: 4.3**. The samples were being collected on monthly basis. The descriptions of the locations are given below:

SW-1 Karo River Water before ML Area

The sample was collected from Karo river around 100 m up stream of the ML area and analyzed for 31 parameters as per the Surface Water Quality Standards IS 2296 (Class – C) to find out the back ground concentration of the parameters.

SW-2 Karo River Water after ML Area

The sample was collected from Karo river around 100 m downstream of the ML area and analyzed for 31 parameters as per the Surface Water Quality Standards IS 2296 (Class – C) to find out the effect of mining activity on concentration of the parameters in the downstream of the river.

SW-3 Samij Nallah Water before ML Area

The sample was collected from Samij nallah around 100 m up stream of the ML area and analyzed for 31 parameters as per the Surface Water Quality Standards IS 2296 (Class – C) to find out the back ground concentration of the parameters.

SW-4 Samij Nallah Water after ML Area

The sample was collected from Samij nallah around 100 m downstream of the ML area and analyzed for 31 parameters Surface Water Quality Standards IS 2296 (Class – C) to find out the effect of mining activity on concentration of the parameters in the downstream of the nallah.

SW-5 Kuradihi Nallah Water before ML Area

The sample was collected from Kuradihi nallah around 100 m up stream of the ML area and analyzed for 31 parameters Surface Water Quality Standards IS 2296 (Class – C) to find out the back ground concentration of the parameters.

SW-6 Kuradihi Nallah Water after ML Area

The sample was collected from Kuradihi nallah around 100 m downstream of the ML area and analyzed for 31 parameters Surface Water Quality Standards IS 2296 (Class – C) to find out the effect of mining activity on concentration of the parameters in the downstream of the nallah.

SW-7 Teherai Nallah Water before ML Area

The sample was collected from Teherai nallah around 100 m up stream of the ML area and analyzed for 31 parameters Surface Water Quality Standards IS 2296 (Class – C) to find out the back ground concentration of the parameters.

SW-8 Teherai Nallah Water after ML Area

The sample was collected from Teherai nallah around 100 m downstream of the ML area and analyzed for 31 parameters Surface Water Quality Standards IS 2296 (Class – C) to find out the effect of mining activity on concentration of the parameters in the downstream of the nallah.

4.4 Ground Water Level:

Ground Water level were monitored by fixing a network of existing dug wells of 3(Three) nos in the nearby villages as well as in the core zone. A map showing the sampling locations is depicted in **Figure No: 4.4**. Ground water levels were measured during month of May and August to know the

amount of seasonal fluctuation and availability of ground water during summer season of the area. The details of the sampling locations are described below:

GW-1 Village Dengula Dug Well

The water level was measured from the dug well of Dengula village near Panchayat road to know the availability as the villagers are using the dug well water for their drinking purpose.

GW-2 Village Bandhal Dug Well

The water level was measured from the dug well of Bandhal village to know the availability as the villagers are using the dug well water for their drinking purpose.

GW-3 PTA Mines Office Dug Well

The water level was measured from the dug well of the mines office of M/s Penguin Trading and Agencies Ltd to know the availability during the lean seasons as the water is used for supply to hutting and mines office.

4.5 Ground Water Quality:

Ground Water quality was monitored from a net work of existing dug wells/ bore wells/ tube wells in core as well as in buffer zone. Samples were collected during the month of May and August for evaluating the quality of the water and analyzed as per IS 10500.

GW-1 Mines Office Dug Well

The water sample was collected from the dug well of the mines office of M/s Penguin Trading and Agencies Ltd and was tested for drinking water quality as the water is used by the officials for their drinking purpose and also supply of drinking water for the workers working in the mines. The water is also supplied in the labour hutting near by the mines office.

GW-2 Village Dengula Dug Well

The water sample was collected from the dug well of Dengula village near Panchayat road and was tested for drinking water quality as the villagers are using the dug well water for their drinking purpose.

GW-3 Village Raikela Bore Well

The water sample was collected from the bore well of Raikela village and was tested for drinking water quality as the villagers are using the bore well water for their drinking and domestic purpose.

GW-4 Village Bandhal Dug Well

The water sample was collected from the dug well of Bandhal village and was tested for drinking water quality as the villagers are using the dug well water for their drinking purpose.

GW-5 Bore Well Near Bottom Weigh Bridge

The water sample was collected from the bore well near the bottom weigh bridge and was analysed for drinking water quality as the water is supplied for drinking purpose in the mine for the mine workers.

Figure No: 4.3 SURFACE WATER QUALITY & STREAM FLOW MEASUREMENT LOCATION MAP

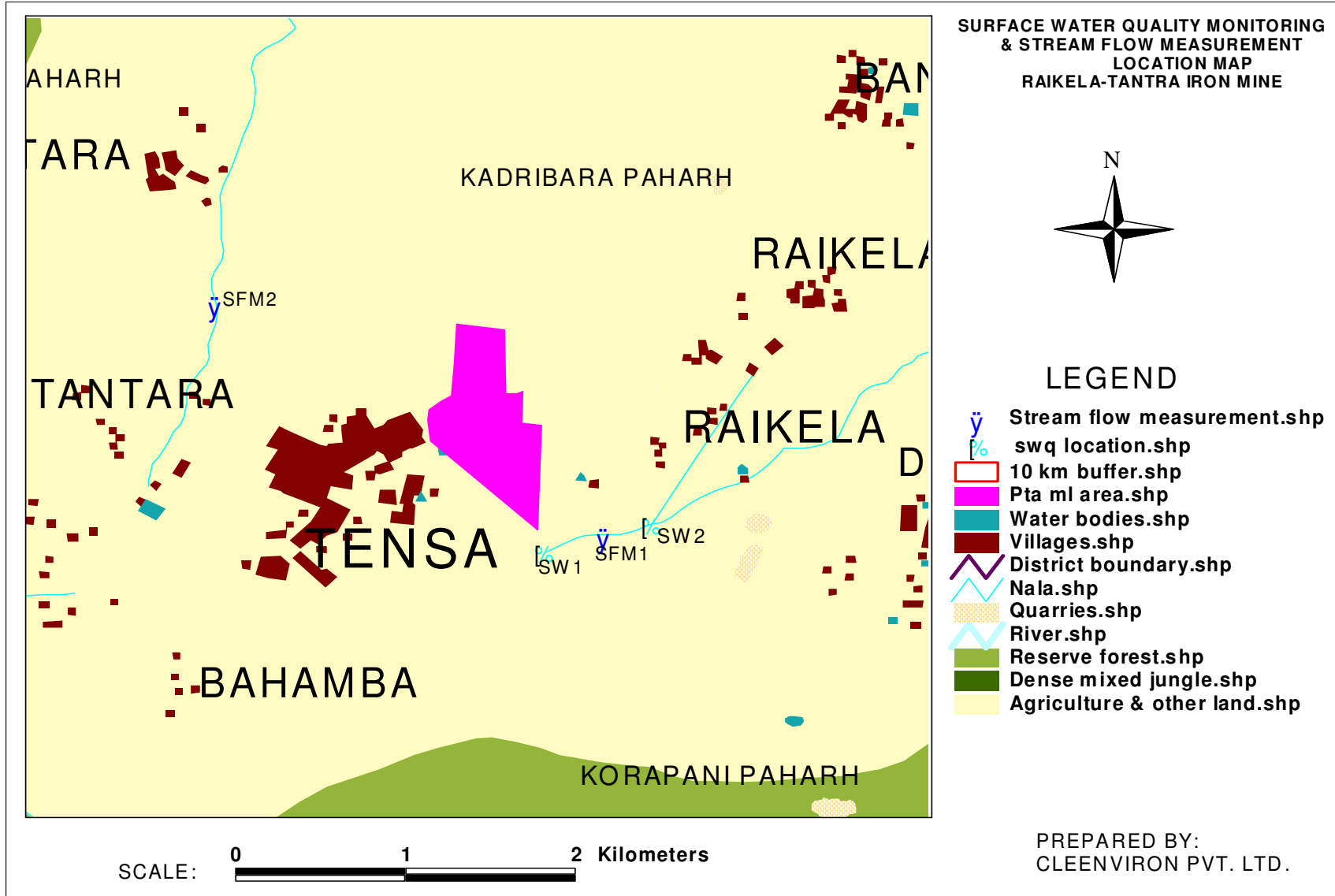
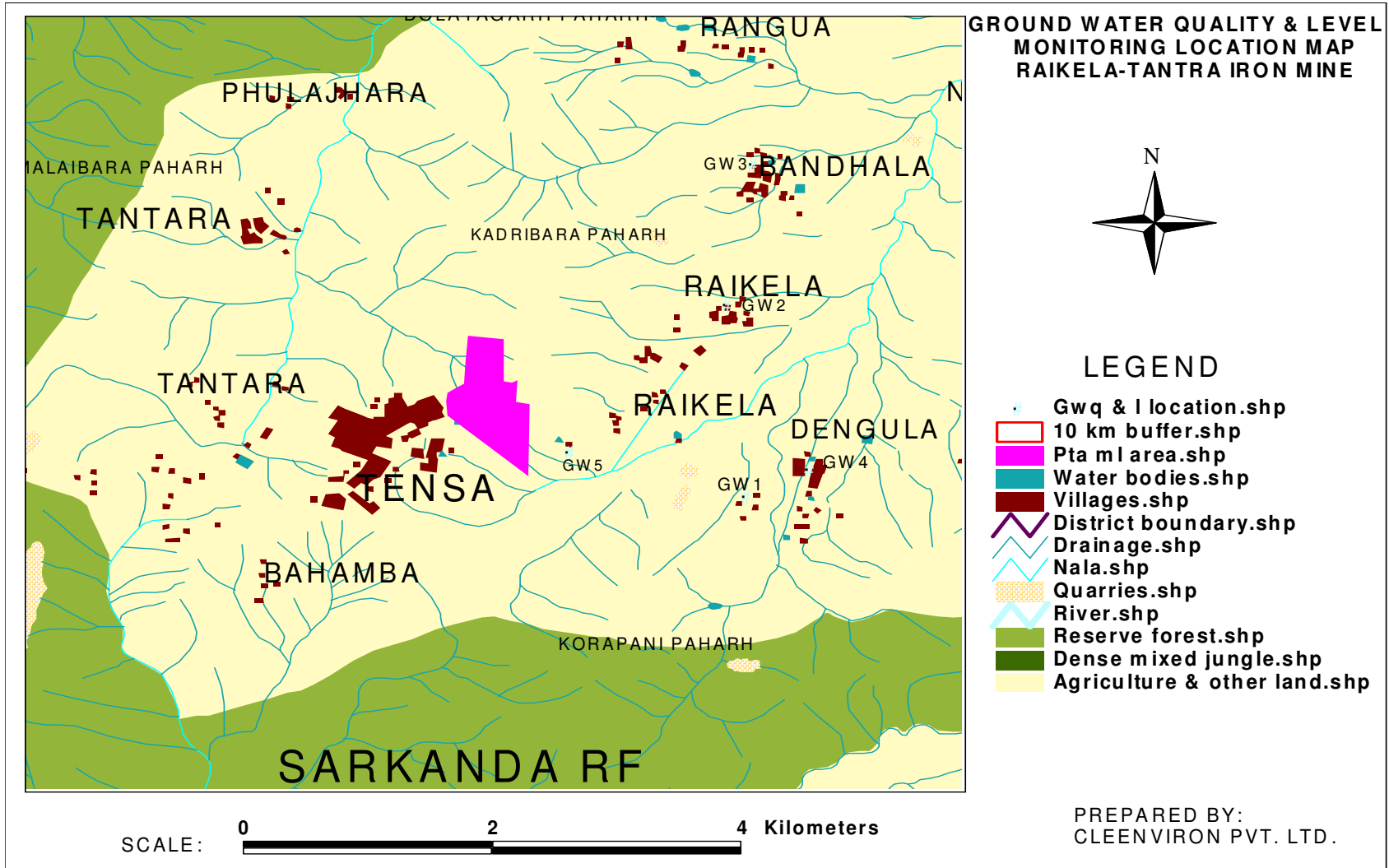


Figure No: 4.4 GROUND WATER LEVEL AND QUALITY MONITORING LOCATION MAP



4.6 Noise Level Monitoring

Noise levels were measured at total 9(Nine) different locations within the core as well as buffer zone. To assess the impact of the mining operation on the ambient noise level two locations were fixed within the core zone i.e. within the quarry during operation of machineries and second at the mines office area. Four locations were selected at source and the monitoring was carried out to assess the SPL in dB(A) from the HEMM during operation. Three more locations are fixed at three villages within the buffer zone to know the noise level at the receptor locations due to the mining activity. The sampling locations are shown in the **Figure No: 4.5**. A brief description of the monitoring location is given below:

N-1 Drill Machine Operator's Cabin

This monitoring was carried out to assess the noise level due to the operation of the Drill Machine on the Operator. This monitoring was done as per the DGMS guidelines for occupational safety of the workers. The monitoring was carried out near the Drill Machine at a distance of 2 m.

N-2 Excavator Operator's Cabin

This monitoring was carried out to assess the noise level due to the operation of the excavator on the Operator. This monitoring was done as per the DGMS guidelines for occupational safety of the workers. The monitoring was carried out within the Operator's Cabin.

N-3 Loader Operator's Cabin

This monitoring was carried out to assess the noise level due to the operation of the Loader on the Operator. This monitoring was done as per the DGMS guidelines for occupational safety of the workers. The monitoring was carried out within the Operator's Cabin.

N-4 Dumper Operator's Cabin

This monitoring was carried out to assess the noise level due to the operation of the Dumper on the Operator. This monitoring was done as per the DGMS guidelines for occupational safety of the workers. The monitoring was carried out within the Operator's Cabin.

N-5 Quarry Area during Mining Operation

This station was selected to assess the ambient noise level due to the operation of HEMM within the quarry area during ongoing mining works. The monitoring was carried out inside the quarry and at distance of 100 m from the operating machines.

N-6 Mines Office area

This station was selected to assess the ambient noise level due to the mining activity at mines office area. The monitoring was carried out within the mines office premises.

N-7 Village Dengula

This station was selected to assess the ambient noise level in the buffer zone at the receptor locations and the impact of the mining activity on the village. The monitoring was carried out within the village Dengula.

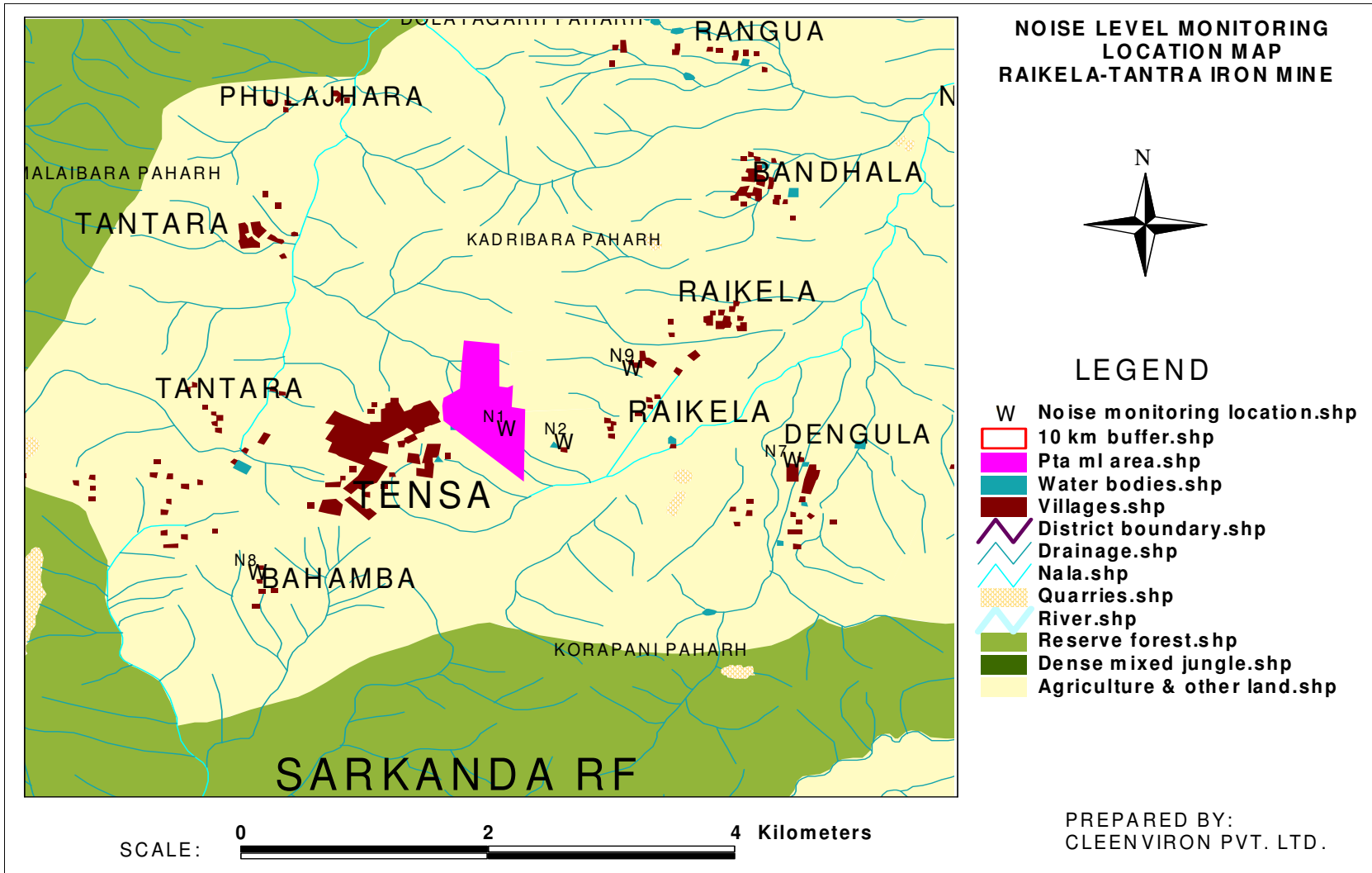
N-8 Village Raikela

This station was selected to assess the ambient noise level in the buffer zone at the receptor locations and the impact of the mining activity on the village. The monitoring was carried out within the village Raikela.

N-9 Village Bandhal

This station was selected to assess the ambient noise level in the buffer zone at the receptor locations and the impact of the mining activity on the village. The monitoring was carried out within the village Bandhal.

Figure No: 4.5 NOISE LEVEL & SOIL QUALITY MONITORING LOCATION MAP



4.7 Soil Quality Monitoring

Soil monitoring is carried out at two different locations, one near the OB dump and other from the agriculture land near the Mines office in the buffer zone. The sampling locations are shown in the **Figure No: 4.5**. A brief description of the monitoring location is given below:

S-1 Land Near the OB Dump

This location is selected to assess the soil quality due to dumping of Over burden and wastes generated from the mining operation.

S-2 Agriculture Land near the Mines Office

This location is selected to assess the soil quality in the buffer zone and its effects due to the runoff from the mining lease area to the nearby agriculture land during monsoon.

5.0 METHODOLOGY OF SAMPLING & ANALYTICAL PROCEDURES

5.1 Micro-meteorological Monitoring

An Automatic Weather Monitoring station is installed in front of the Mine Site office to collect site specific micro-meteorological data, the station is installed at the highest elevation point of the mines with a tripod stand and is fixed permanently. The station is having provision for monitoring of Wind Speed, Wind Direction, Temperature, Relative Humidity and Rainfall. The instrument is having data logging facility at an interval of 1 hour and can store up to 8000 data without interruption as it is operated by Solar Panel and one 12 volt battery for night time operation.

5.2 Ambient Air Monitoring

Air quality samples were monitored for significant parameters like, PM_{2.5}, PM₁₀, SO₂, NO₂ & CO. For sampling and analysis methods prescribed by CPCB were followed and Respirable Dust Samplers (RDS) and Fine Particulate Samplers, Make: Universal Scientific Instruments & Calibration were used at the site. For CO measurements a direct reading instrument having electrochemical sensor based calibrated digital monitor was used at the site and being operated continuously.

24 hours continuous samplings were carried out continuously at all the three locations within core zone. Within buffer zone the monitoring is done once in a month.

All the analytical techniques followed are as per CPCB approved and as per Indian Standard methods.

Sulphur Dioxide sampling and analysis was carried out by following Improved West & Gaeke Method. The detection limit was 3µg/m³.

Nitrogen Oxides sampling and analysis was carried out by following modified Jacob & Hochheiser method (Sodium Arsenite Method). The detection limit was 6µg/m³.

5.3 Fugitive Dust Emission Monitoring

Fugitive Dust emission samples were collected for parameter like, PM₁₀. For sampling and analysis, methods prescribed by CPCB were followed and Respirable Dust Samplers Model: AQS 136, Make: Universal Scientific Instruments & Calibration, were used at the site.

5.4 Water Quality Sampling

As per the standard practice, one sample from each station was collected once, during the month of May and August. Grab water samples were collected in plastic container by standard sampling technique. Necessary precautions were taken for sample preservation. The parameters like pH, Temp and Conductivity were measured at the site by using portable water analysis kit from WTW, Germany. All other parameters were analysed as per the standard methods for Water and Waste Water analysis by APHA 23rd edition.

5.5 Noise Level Monitoring

Ambient Noise level monitoring was carried out with an integrating Sound Level Meter, Model: SLM 100, Make: Envirotech Instruments Pvt. Ltd. in dB(A) and Model: SL 4001, Make: Lutron. The measurements were collected at a height of 1.5m from the ground level and away from any sound reflecting sources like walls and buildings etc.

The Ambient Noise monitoring was carried out on continuous basis by the data logging system of the instrument and data are logged on at every minute for 24 hours. The Sound Pressure Level was measured and Lmin, Lmax & Leq were calculated and interpreted for data analysis.

5.6 Soil Quality Monitoring

Soil monitoring was carried out by collecting soil samples from the two different sites as per the Methods Manual for Soil Testing by Department of Agriculture & Cooperation, Ministry of Agriculture, Govt. of India.

6.0 DATA ANALYSIS

6.1 Micro-meteorological Data

6.1.1 Wind Speed & Wind Direction

During the entire period from 1st April to 30th September all total 4380 no. of data are recorded by the instrument and after interpretation of the collected data it was found that Calm condition prevailed over 2.72%, while considering the 24 hourly data. 3.35% calm condition prevailed from morning 6 hrs to 14hrs for the entire study period, 3.60% calm condition prevailed from 14hrs to 22hrs and 1.64% calm condition prevailed from 22hrs to 06hrs. The predominant wind directions were from SW with average wind speed 3.34 m/sec. The wind rose diagrams for the entire study period are depicted on the **Figure No: 6.1, 6.2, 6.3 & 6.4.**

6.1.2 Temperature

The maximum & minimum temperature during the entire study period was divided in to two parts as the study period was covering summer as well as monsoon seasons. The Minimum temperature during the summer season was found to be 17.92°C and the Maximum temperature was found to be 37.19°C up to the end of 30th June. The minimum and maximum relative humidity during the summer season is found to be 11.9% and 96.22%.

The minimum and maximum temperature during the monsoon season i.e. from July to September was found to be 20.8°C and 32.73°C. The minimum and maximum relative humidity during the monsoon season is found to be 64.73% and 97.26%. **Table No 6.1** shows a summary of micro-meteorological data collected for the entire period.

6.1.3 Rainfall

The total rain fall from 1st April to 30th September was observed to be 791.62 mm. during the study period. A month wise rainfall data recorded at the site is depicted in **Table No 6.1.**

Table No: 6.1
A Summary of the Micro-meteorological Data

SI No	Parameters	From April – September 2021
1	Predominant Wind Direction	SW To NE
2	Calm Condition %	2.72
3	Average Wind Speed m/sec	3.34
4	Temperature °C Summer Season Minimum Maximum Monsoon Season Minimum Maximum	 17.92 37.19 20.80 32.73
5	Relative Humidity (%) Minimum Maximum	 11.90 97.26
6	Rain Fall in mm April May June July August September Total	 16.62 121.6 215.8 150.8 69.4 217.4 791.62

Figure No: 6.1 **Wind Rose Diagram & Wind Class Distribution for 24 Hours**

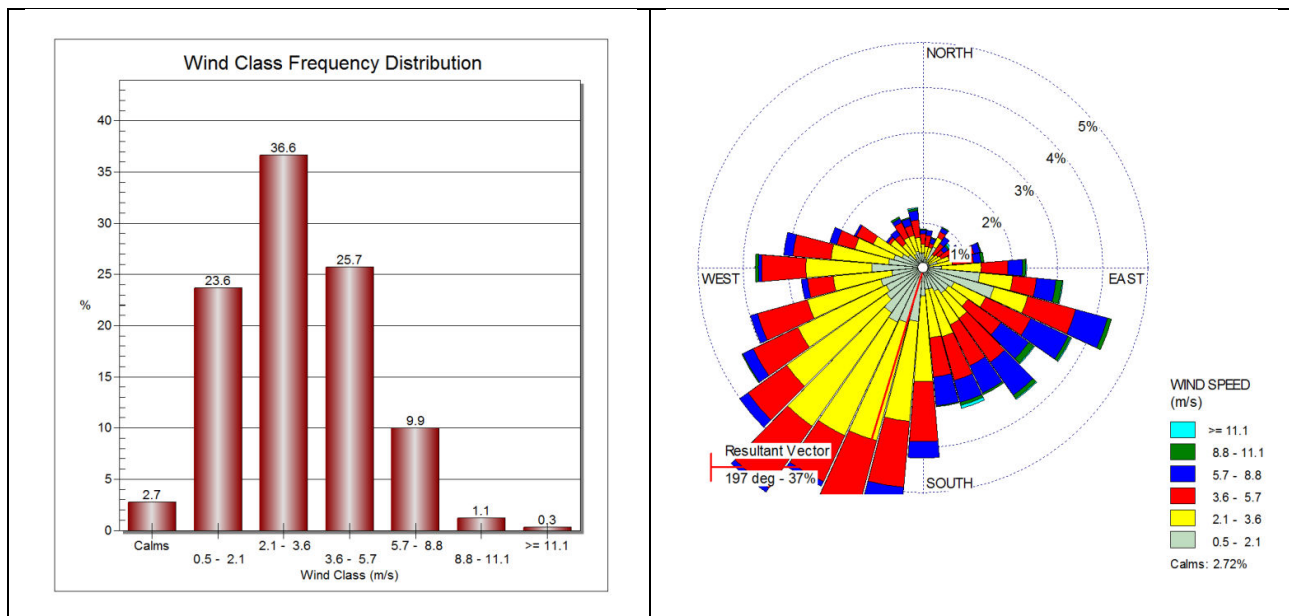


Figure No: 6.2 Wind Rose Diagram & Wind Class Distribution from 6 – 14 Hours

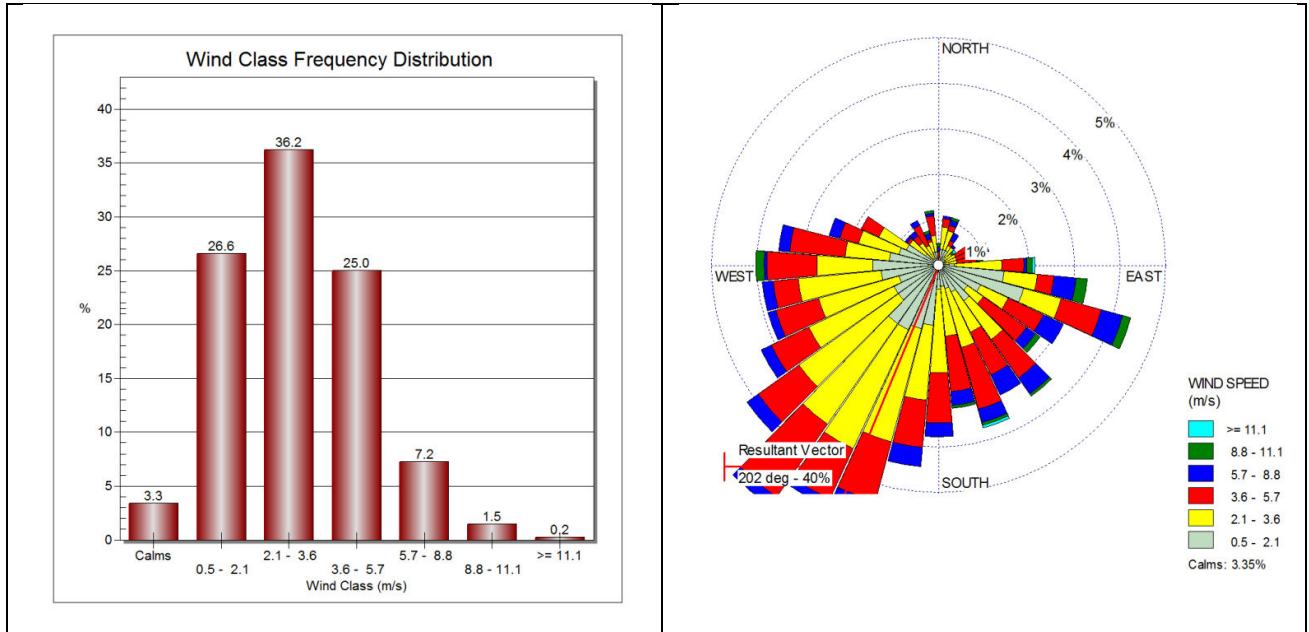


Figure No: 6.3 Wind Rose Diagram & Wind Class Distribution from 14 – 22 Hours

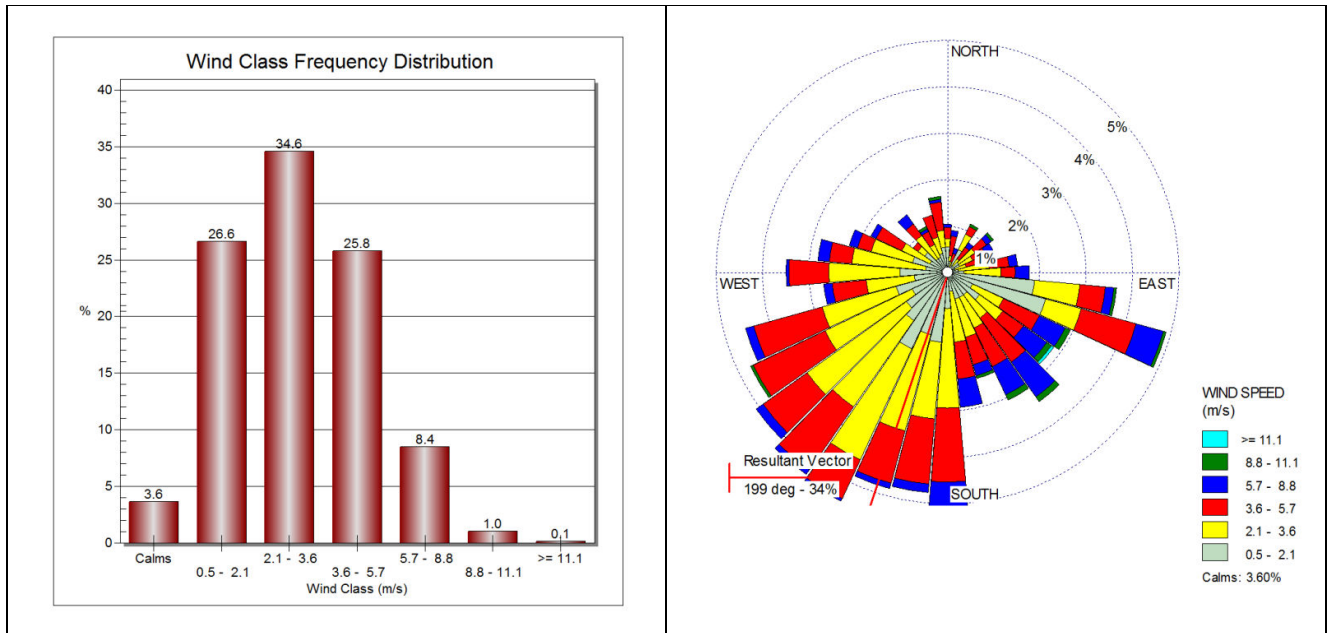
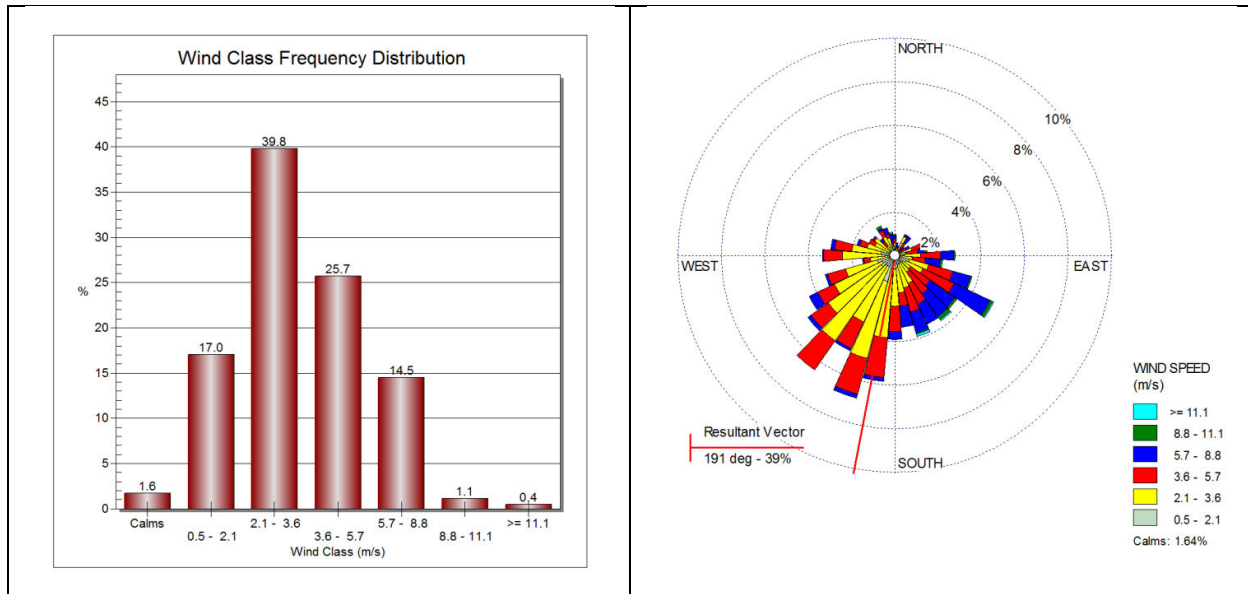


Figure No: 6.4 Wind Rose Diagram & Wind Class Distribution from 22 – 06 Hours



6.2 Ambient Air Quality Data

6.2.1 Near Mines Site Office (A-1) [Core Zone]

PM2.5

Data as given in the **Table No: 6.2** shows that the maximum value was $26.84\mu\text{g}/\text{m}^3$, the lowest value was $19.4\mu\text{g}/\text{m}^3$ and the average value was $22.3\mu\text{g}/\text{m}^3$.

All the readings are below the permissible limit of $60\mu\text{g}/\text{m}^3$ as specified in the National Ambient Air Quality Standards, CPCB Notification 18th November 2009.

PM10

The data given in the **Table No: 6.2** shows the maximum value was $78.88\mu\text{g}/\text{m}^3$, the lowest value was $52.4\mu\text{g}/\text{m}^3$ and the average value was $63.6\mu\text{g}/\text{m}^3$.

All the readings are below the permissible limit of $100\mu\text{g}/\text{m}^3$ as specified in the National Ambient Air Quality Standards, CPCB Notification 18th November 2009.

SO₂

The data given in the **Table No: 6.2** shows the maximum value was $5.45\mu\text{g}/\text{m}^3$, the lowest value was $4.1\mu\text{g}/\text{m}^3$ and the average value was $4.9\mu\text{g}/\text{m}^3$.

NO₂

The data given in the **Table No: 6.2** shows the maximum value was $18.0\mu\text{g}/\text{m}^3$, the lowest value was $15.05\mu\text{g}/\text{m}^3$ and the average value was $16.9\mu\text{g}/\text{m}^3$.

All the readings are below the permissible limit of $80\mu\text{g}/\text{m}^3$ as specified in the National Ambient Air Quality Standards, CPCB Notification 18th November 2009.

CO

All the CO readings are found to be below the detection limit of 114.4µg/m³

Table No: 6.2

Months	PM2.5	PM10	SO ₂	NO ₂
April	26.84	78.88	4.10	16.22
May	25.15	73.00	5.24	18.00
June	19.40	52.40	4.89	17.35
July	19.61	56.87	4.67	15.05
August	21.48	59.79	5.45	16.79
September	21.38	60.81	5.04	17.88
Minimum	19.4	52.4	4.1	15.05
Maximum	26.84	78.88	5.45	18
Average	22.3	63.6	4.9	16.9
98% tile	19.4	52.8	4.2	15.2

6.2.2 Tantra Section Near Lease Boundary (A-2) [Core Zone]

PM2.5

Data as given in the **Table No: 6.3** shows that the maximum value was 27.68µg/m³, the lowest value was 20.75µg/m³ and the average value was 24.1µg/m³.

All the readings are below the permissible limit of 60µg/m³ as specified in the National Ambient Air Quality Standards, CPCB Notification 18th November 2009.

PM10

The data given in the **Table No: 6.3** shows the maximum value was 77.5µg/m³, the lowest value was 58.68µg/m³ and the average value was 68.7µg/m³.

All the readings are below the permissible limit of 100µg/m³ as specified in the National Ambient Air Quality Standards, CPCB Notification 18th November 2009.

SO₂

The data given in the **Table No: 6.3** shows the maximum value was 5.64µg/m³, the lowest value was 4.46µg/m³ and the average value was 5.2µg/m³.

NO₂

The data given in the **Table No: 6.3** shows the maximum value was 20.48µg/m³, the lowest value was 15.82µg/m³ and the average value was 18.0µg/m³.

All the readings are below the permissible limit of 80µg/m³ as specified in the National Ambient Air Quality Standards, CPCB Notification 18th November 2009.

CO

All the CO readings are found to be below the detection limit of 114.4µg/m³

Table No: 6.3

Months	PM2.5	PM10	SO₂	NO₂
April	27.68	77.50	4.46	15.82
May	26.00	74.48	5.64	20.48
June	24.82	71.18	5.08	18.85
July	24.48	68.85	5.30	17.56
August	20.75	58.68	5.40	17.02
September	20.81	61.60	5.19	18.56
Minimum	20.75	58.68	4.46	15.82
Maximum	27.68	77.5	5.64	20.48
Average	24.1	68.7	5.2	18.0
98% tile	20.8	59.0	4.5	15.9

6.2.3 Near Main Entry Gate of Mines (A-3) [Core Zone]

PM2.5

Data as given in the **Table No: 6.4** shows that the maximum value was 30.35µg/m³, the lowest value was 22.02µg/m³ and the average value was 25.0µg/m³.

All the readings are below the permissible limit of 60µg/m³ as specified in the National Ambient Air Quality Standards, CPCB Notification 18th November 2009.

PM10

The data given in the **Table No: 6.4** shows the maximum value was 81.9µg/m³, the lowest value was 62.23µg/m³ and the average value was 71.6µg/m³.

All the readings are below the permissible limit of 100µg/m³ as specified in the National Ambient Air Quality Standards, CPCB Notification 18th November 2009.

SO₂

The data given in the **Table No: 6.4** shows the maximum value was 5.64µg/m³, the lowest value was 4.29µg/m³ and the average value was 5.1µg/m³.

NO₂

The data given in the **Table No: 6.4** shows the maximum value was 18.11µg/m³, the lowest value was 16.45µg/m³ and the average value was 17.1µg/m³.

All the readings are below the permissible limit of 80µg/m³ as specified in the National Ambient Air Quality Standards, CPCB Notification 18th November 2009.

CO

All the CO readings are found to be below the detection limit of 114.4µg/m³

Table No: 6.4

Months	PM2.5	PM10	SO ₂	NO ₂
April	27.83	81.90	4.29	16.50
May	30.35	79.67	4.70	16.45
June	24.68	73.38	4.96	17.06
July	22.40	66.11	5.42	16.52
August	22.02	62.23	5.64	18.08
September	22.70	66.02	5.38	18.11
Minimum	22.02	62.23	4.29	16.45
Maximum	30.35	81.9	5.64	18.11
Average	25.0	71.6	5.1	17.1
98% tile	22.1	62.6	4.3	16.5

6.2.4 Mines Office Area (A-4) [Buffer Zone]**PM2.5**

Data as given in the **Table No: 6.5** shows that the maximum value was 24 $\mu\text{g}/\text{m}^3$, the lowest value was 8 $\mu\text{g}/\text{m}^3$ and the average value was 20.3 $\mu\text{g}/\text{m}^3$.

All the readings are below the permissible limit of 60 $\mu\text{g}/\text{m}^3$ as specified in the National Ambient Air Quality Standards, CPCB Notification 18th November 2009.

PM10

The data given in the **Table No: 6.5** shows the maximum value was 70 $\mu\text{g}/\text{m}^3$, the lowest value was 29 $\mu\text{g}/\text{m}^3$ and the average value was 55.7 $\mu\text{g}/\text{m}^3$.

All the readings are below the permissible limit of 100 $\mu\text{g}/\text{m}^3$ as specified in the National Ambient Air Quality Standards, CPCB Notification 18th November 2009.

SO₂

The data given in the **Table No: 6.5** shows the maximum value was 9.0 $\mu\text{g}/\text{m}^3$, the lowest value was 5.0 $\mu\text{g}/\text{m}^3$ and the average value was 6.5 $\mu\text{g}/\text{m}^3$.

NO₂

The data given in the **Table No: 6.5** shows the maximum value was 29 $\mu\text{g}/\text{m}^3$, the lowest value was 20 $\mu\text{g}/\text{m}^3$ and the average value was 24.8 $\mu\text{g}/\text{m}^3$.

All the readings are below the permissible limit of 80 $\mu\text{g}/\text{m}^3$ as specified in the National Ambient Air Quality Standards, CPCB Notification 18th November 2009.

CO

All the CO readings are found to be below the detection limit of 114.4 $\mu\text{g}/\text{m}^3$

Table No: 6.5

Date	PM2.5	PM10	SO₂	NO₂
10.04.2021	22	40	5	29
06.05.2021	24	67	9	24
05.06.2021	23	70	5	27
05.07.2021	8	29	8	22
06.08.2021	24	61	5	20
20.09.2021	21	67	7	27
Minimum	8	29	5	20
Maximum	24	70	9	29
Average	20.3	55.7	6.5	24.8
98% tile	9.3	30.1	5.0	20.2

6.2.5 Village Dengula (A-5) [Buffer Zone]**PM2.5**

Data as given in the **Table No: 6.6** shows that the maximum value was 27 $\mu\text{g}/\text{m}^3$, the lowest value was 9 $\mu\text{g}/\text{m}^3$ and the average value was 20.0 $\mu\text{g}/\text{m}^3$.

All the readings are below the permissible limit of 60 $\mu\text{g}/\text{m}^3$ as specified in the National Ambient Air Quality Standards, CPCB Notification 18th November 2009.

PM10

The data given in the **Table No: 6.6** shows the maximum value was 84 $\mu\text{g}/\text{m}^3$, the lowest value was 27 $\mu\text{g}/\text{m}^3$ and the average value was 61.0 $\mu\text{g}/\text{m}^3$.

All the readings are below the permissible limit of 100 $\mu\text{g}/\text{m}^3$ as specified in the National Ambient Air Quality Standards, CPCB Notification 18th November 2009.

SO₂

The data given in the **Table No: 6.6** shows the maximum value was 12.0 $\mu\text{g}/\text{m}^3$, the lowest value was 5.0 $\mu\text{g}/\text{m}^3$ and the average value was 7.3 $\mu\text{g}/\text{m}^3$.

NO₂

The data given in the **Table No: 6.6** shows the maximum value was 41 $\mu\text{g}/\text{m}^3$, the lowest value was 17 $\mu\text{g}/\text{m}^3$ and the average value was 26.2 $\mu\text{g}/\text{m}^3$.

All the readings are below the permissible limit of 80 $\mu\text{g}/\text{m}^3$ as specified in the National Ambient Air Quality Standards, CPCB Notification 18th November 2009.

CO

All the CO readings are found to be below the detection limit of 114.4 $\mu\text{g}/\text{m}^3$

Table No: 6.6

Date	PM2.5	PM10	SO₂	NO₂
17.04.2021	26	84	5	19
12.05.2021	19	57	8	27
07.06.2021	16	57	6	24
12.07.2021	9	27	5	17
09.08.2021	23	68	12	41
30.09.2021	27	73	8	29
Minimum	9	27	5	17
Maximum	27	84	12	41
Average	20.0	61.0	7.3	26.2
98% tile	9.7	30.0	5.0	17.2

6.2.6 Tensa Town (A-6) [Buffer Zone]**PM2.5**

Data as given in the **Table No: 6.7** shows that the maximum value was 29 $\mu\text{g}/\text{m}^3$, the lowest value was 20 $\mu\text{g}/\text{m}^3$ and the average value was 25.8 $\mu\text{g}/\text{m}^3$.

All the readings are below the permissible limit of 60 $\mu\text{g}/\text{m}^3$ as specified in the National Ambient Air Quality Standards, CPCB Notification 18th November 2009.

PM10

The data given in the **Table No: 6.7** shows the maximum value was 89 $\mu\text{g}/\text{m}^3$, the lowest value was 63 $\mu\text{g}/\text{m}^3$ and the average value was 76.2 $\mu\text{g}/\text{m}^3$.

All the readings are below the permissible limit of 100 $\mu\text{g}/\text{m}^3$ as specified in the National Ambient Air Quality Standards, CPCB Notification 18th November 2009.

SO₂

The data given in the **Table No: 6.7** shows the maximum value was 10.0 $\mu\text{g}/\text{m}^3$, the lowest value was 5.0 $\mu\text{g}/\text{m}^3$ and the average value was 7.2 $\mu\text{g}/\text{m}^3$.

NO₂

The data given in the **Table No: 6.7** shows the maximum value was 40.0 $\mu\text{g}/\text{m}^3$, the lowest value was 16.0 $\mu\text{g}/\text{m}^3$ and the average value was 23.8 $\mu\text{g}/\text{m}^3$.

All the readings are below the permissible limit of 80 $\mu\text{g}/\text{m}^3$ as specified in the National Ambient Air Quality Standards, CPCB Notification 18th November 2009.

CO

All the CO readings are found to be below the detection limit of 114.4 $\mu\text{g}/\text{m}^3$

Table No: 6.7

Date	PM2.5	PM10	SO₂	NO₂
22.04.2021	29	89	5	20
17.05.2021	29	84	9	40
24.06.2021	20	63	5	21
19.07.2021	26	75	6	16
16.08.2021	27	77	8	22
29.09.2021	24	69	10	24
Minimum	20	63	5	16
Maximum	29	89	10	40
Average	25.8	76.2	7.2	23.8
98% tile	20.4	63.6	5.0	16.4

6.2.7 Village Bahamba (A-7) [Buffer Zone]**PM2.5**

Data as given in the **Table No: 6.8** shows that the maximum value was 23 $\mu\text{g}/\text{m}^3$, the lowest value was 13 $\mu\text{g}/\text{m}^3$ and the average value was 18.2 $\mu\text{g}/\text{m}^3$.

All the readings are below the permissible limit of 60 $\mu\text{g}/\text{m}^3$ as specified in the National Ambient Air Quality Standards, CPCB Notification 18th November 2009.

PM10

The data given in the **Table No: 6.8** shows the maximum value was 71 $\mu\text{g}/\text{m}^3$, the lowest value was 37 $\mu\text{g}/\text{m}^3$ and the average value was 53.3 $\mu\text{g}/\text{m}^3$.

All the readings are below the permissible limit of 100 $\mu\text{g}/\text{m}^3$ as specified in the National Ambient Air Quality Standards, CPCB Notification 18th November 2009.

SO₂

The data given in the **Table No: 6.8** shows the maximum value was 11.0 $\mu\text{g}/\text{m}^3$, the lowest value was 5.0 $\mu\text{g}/\text{m}^3$ and the average value was 7.2 $\mu\text{g}/\text{m}^3$.

NO₂

The data given in the **Table No: 6.8** shows the maximum value was 32.0 $\mu\text{g}/\text{m}^3$, the lowest value was 17.0 $\mu\text{g}/\text{m}^3$ and the average value was 24.7 $\mu\text{g}/\text{m}^3$.

All the readings are below the permissible limit of 80 $\mu\text{g}/\text{m}^3$ as specified in the National Ambient Air Quality Standards, CPCB Notification 18th November 2009.

CO

All the CO readings are found to be below the detection limit of 114.4 $\mu\text{g}/\text{m}^3$

Table No: 6.8

Date	PM2.5	PM10	SO ₂	NO ₂
28.04.2021	22	71	5	26
31.05.2021	18	49	9	32
26.06.2021	23	66	6	19
31.07.2021	16	47	6	17
19.08.2021	13	37	11	32
21.09.2021	17	50	6	22
Minimum	13	37	5	17
Maximum	23	71	11	32
Average	18.2	53.3	7.2	24.7
98% tile	13.3	38.0	5.1	17.2

Figure No: 6.5 Graphical Representations of PM2.5 Values in Core & Buffer Zone

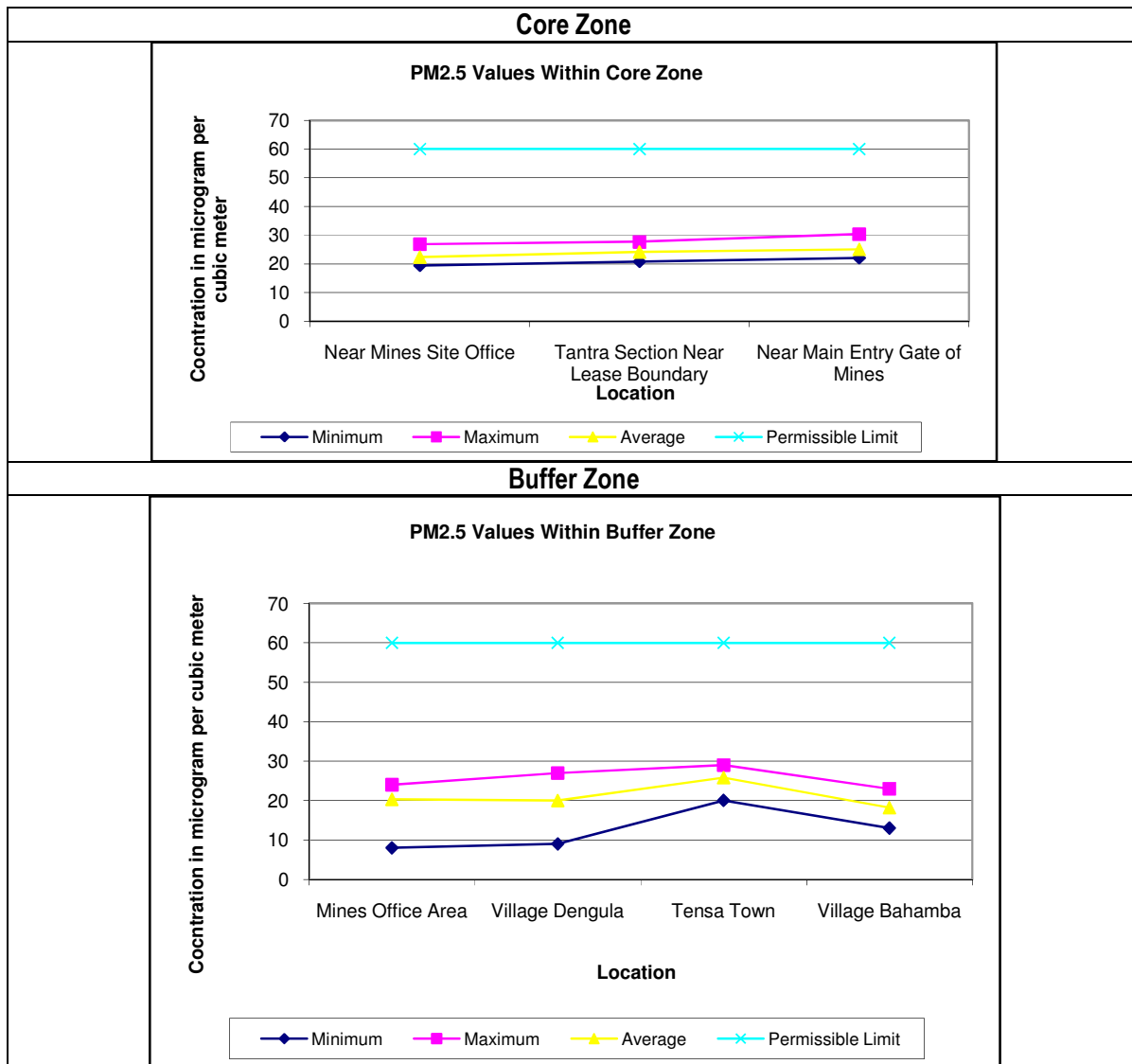


Figure No: 6.6 Graphical Representations of PM10 Values in Core & Buffer Zone

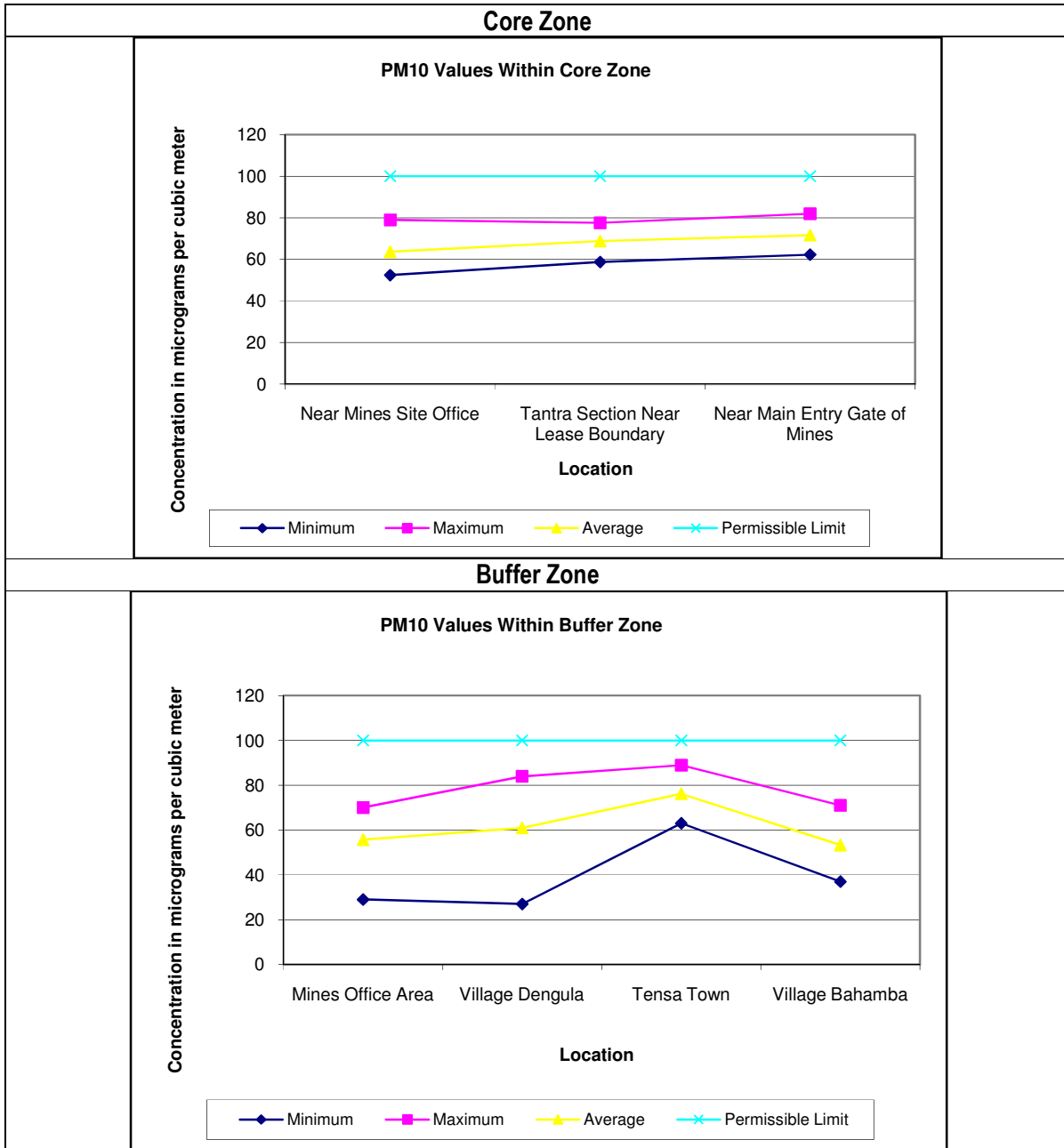


Figure No: 6.7 Graphical Representations of SO₂ Values in Core & Buffer Zone

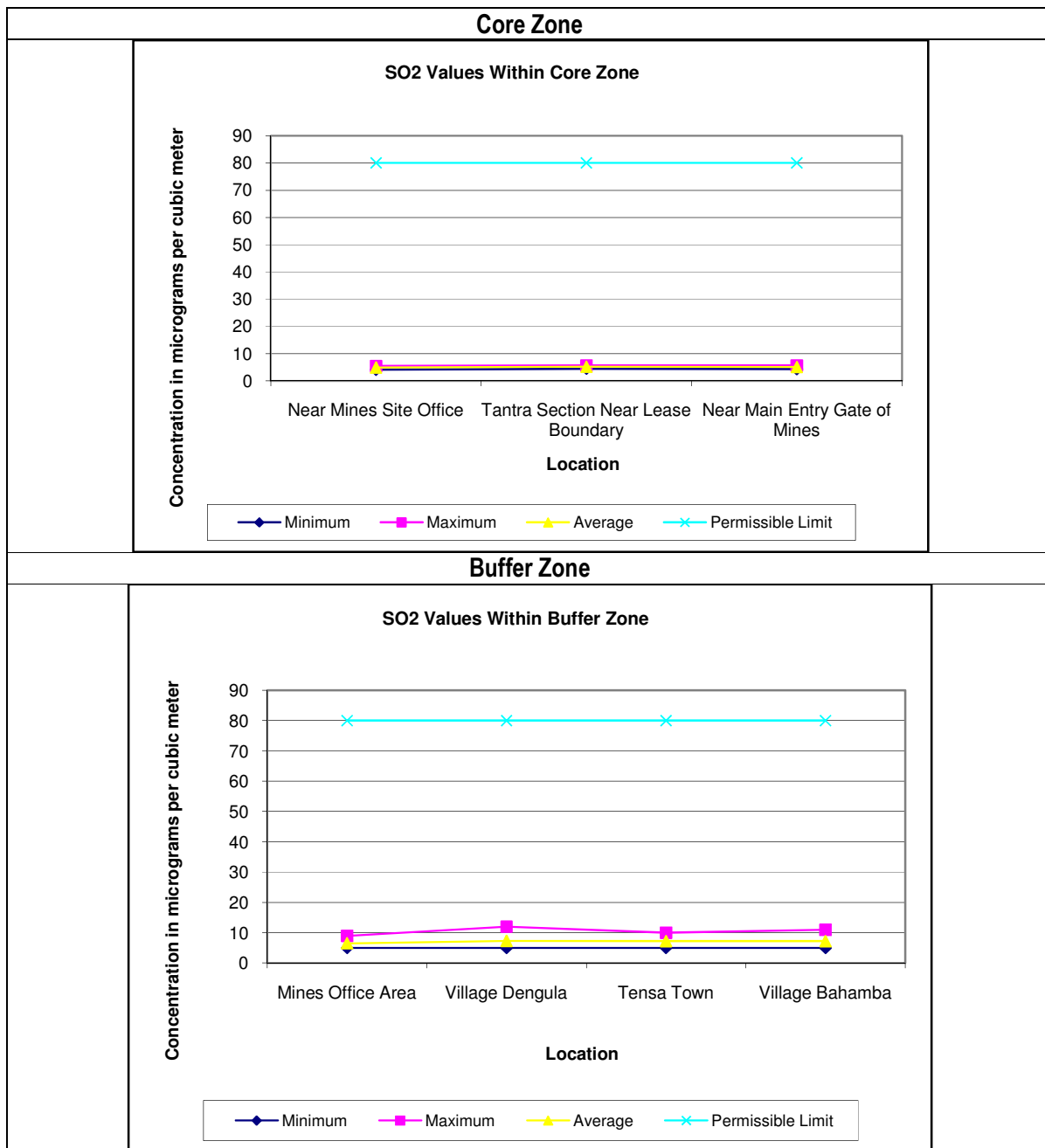
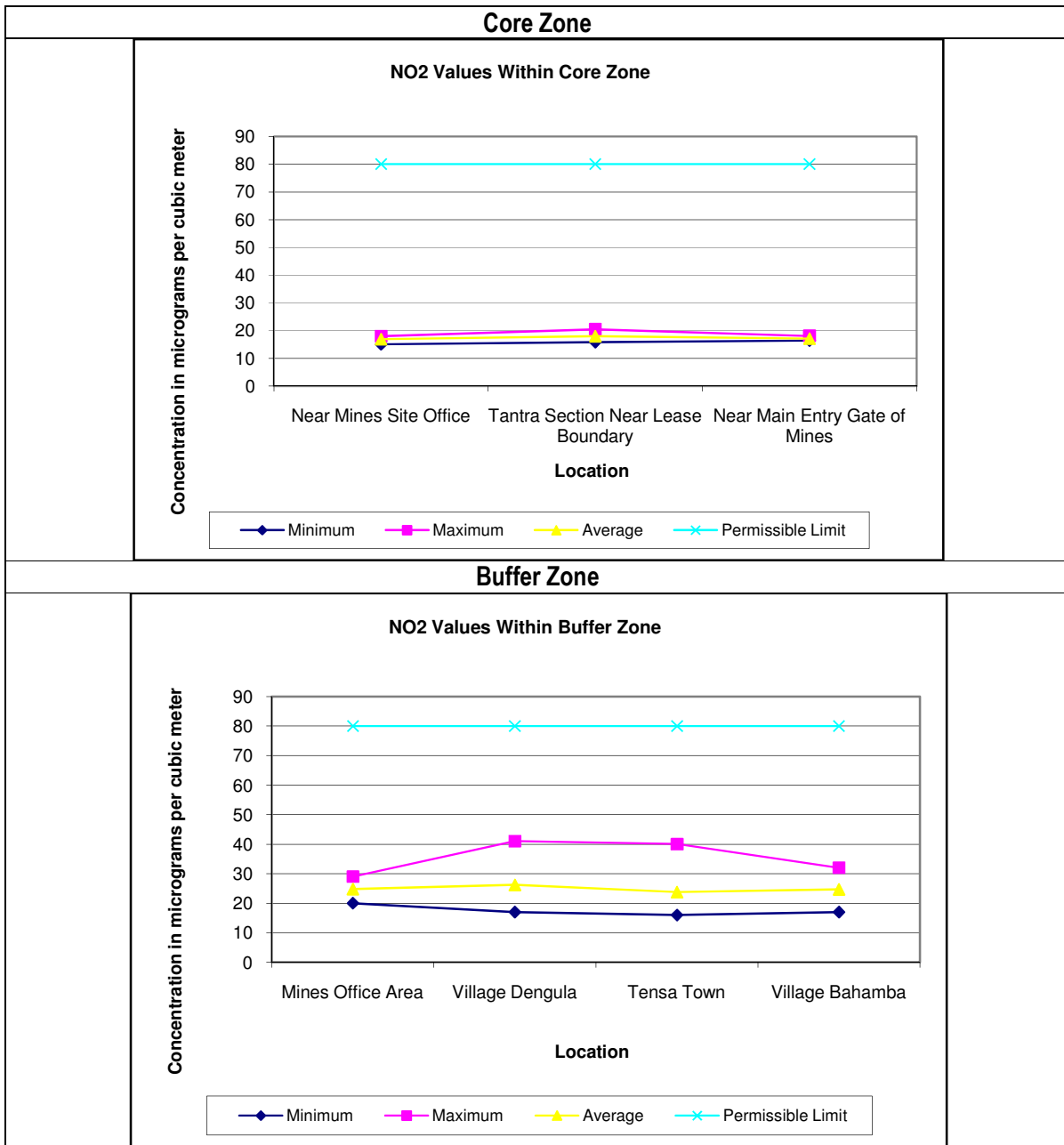


Figure No: 6.8 Graphical Representations of NO₂ Values in Core & Buffer Zone



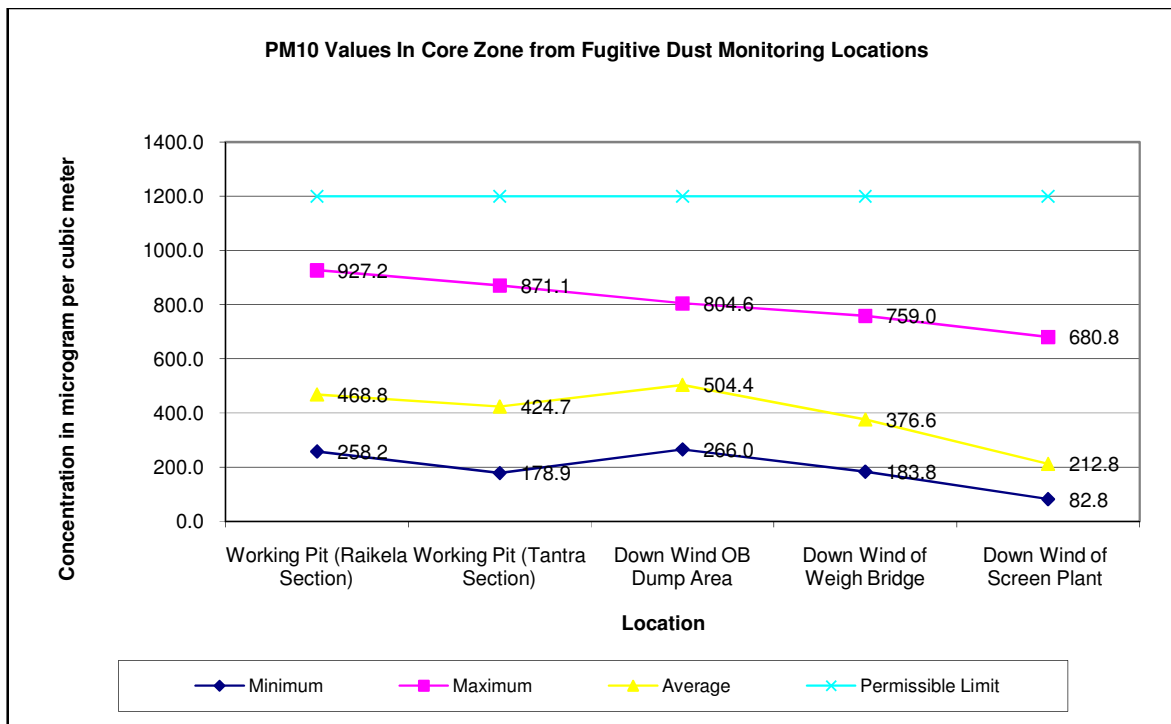
5.1 Fugitive Dust Emission Data

The fugitive dust samples collected from five locations during April to September months is detailed below.

Table 6.9 Fugitive Dust Emission Monitoring Data

MONTHS	Working Pit Raikela Section	Working Pit Tantra Section	Down Wind OB Dump	Down Wind Weigh Bridge	Down Wind Screen/Crusher Plant
APRIL	927.2	871.1	804.6	759	680.8
MAY	577.9	559.2	606.5	415.4	172.8
JUNE	310.5	336.7	608.9	183.8	89.9
JULY	318.4	366.9	419.3	305.2	93.4
AUGUST	420.8	235.2	321.3	379.1	82.8
SEPTEMBER	258.2	178.9	266	216.8	156.8
Minimum	258.2	178.9	266	183.8	82.8
Maximum	927.2	871.1	804.6	759	680.8
Average	468.83	424.67	504.43	376.55	212.75
98%tile Value	263.43	184.53	271.53	187.1	83.51

Figure No: 6.9 Graphical Representations of PM10 Values



5.2 Water Quality

SW-1 Karo River Water Before ML area:

The sample after analysis and in comparison with the Standards prescribed in the Surface Water Quality Standard, IS 2296 (Class – C), water used for Drinking with conventional treatment followed by Disinfection is found to be well within the prescribed limits in both the seasons monitored. The results are detailed in **Table No. 6.10**.

Table No: 6.10
Karo River Water (100 m upstream of the ML area)

SI No	Parameters	Six Monthly Average Value	Surface Water Quality Standard as per IS: 2296 (Class C)
1.	Colour	< 5	300
2.	Odour	Agreeable	-
3.	Taste	Agreeable	-
4.	pH Value	6.07	6.5 – 8.5
5.	Electrical Conductivity	90.80	-
6.	Dissolved Oxygen (Min.)	6.03	4
7.	BOD (3 days at 27°C)	1.40	3
8.	Total Dissolved Solids	58.83	1500
9.	Oil & Grease	< 0.10	0.1
10.	Total Hardness (as CaCO ₃)	32.93	-
11.	Chlorides (as Cl)	11.60	600
12.	Sulfate (as SO ₄)	1.39	400
13.	Total Nitrate (as NO ₃)	< 2.20	50
14.	Free Carbon Dioxide (as CO ₂)	12.76	-
15.	Free Ammonia (as NH ₃)	< 0.012	-
16.	Fluoride (as F)	< 0.05	1.5
17.	Calcium (as Ca)	7.57	-
18.	Magnesium (as Mg)	3.41	-
19.	Copper (as Cu)	< 0.1	1.5
20.	Iron (as Fe)	0.73	50
21.	Manganese (as Mn)	< 0.05	-
21.	Zinc (as Zn)	< 0.02	15
22.	Total Arsenic (as As)	< 0.002	0.2
23.	Mercury (as Hg)	< 0.01	-
24.	Lead (as Pb)	< 0.10	0.1
25.	Cadmium (as Cd)	< 0.05	0.01
26.	Hex. Chromium (as Cr ⁺⁶)	< 0.01	0.05
27.	Selenium (as Se)	< 0.01	0.05
28.	Cyanide (as CN)	< 0.002	0.05
29.	Phenolic Compounds (as C ₆ H ₅ OH)	< 0.002	0.005
30.	Anionic Detergents (as MBAS)	< 0.05	1.0
31.	Total Coliforms	10	5000

SW-2 Karo River Water After ML area:

The sample after analysis and in comparison with the Standards prescribed in the Surface Water Quality Standard, IS 2296 (Class – C), water used for Drinking with conventional treatment followed by Disinfection is found to be well within the prescribed limits in both the seasons monitored. The results are detailed in **Table No. 6.11**.

Table No: 6.11
Karo River Water (100 m Downstream of the ML area)

SI No	Parameters	Six Monthly Average Value	Surface Water Quality Standard as per IS: 2296 (Class C)
1.	Colour	< 5	300
2.	Odour	Agreeable	-
3.	Taste	Agreeable	-
4.	pH Value	6.34	6.5 – 8.5
5.	Electrical Conductivity	85.58	-
6.	Dissolved Oxygen (Min.)	6.07	4
7.	BOD (3 days at 27°C)	1.20	3
8.	Total Dissolved Solids	56.33	1500
9.	Oil & Grease	< 0.10	0.1
10.	Total Hardness (as CaCO ₃)	37.73	-
11.	Chlorides (as Cl)	11.10	600
12.	Sulfate (as SO ₄)	1.95	400
13.	Total Nitrate (as NO ₃)	< 2.20	50
14.	Free Carbon Dioxide (as CO ₂)	11.62	-
15.	Free Ammonia (as NH ₃)	< 0.012	-
16.	Fluoride (as F)	< 0.05	1.5
17.	Calcium (as Ca)	10.41	-
18.	Magnesium (as Mg)	2.94	-
19.	Copper (as Cu)	< 0.1	1.5
20.	Iron (as Fe)	0.88	50
21.	Manganese (as Mn)	< 0.05	-
21.	Zinc (as Zn)	< 0.02	15
22.	Total Arsenic (as As)	< 0.002	0.2
23.	Mercury (as Hg)	< 0.01	-
24.	Lead (as Pb)	< 0.10	0.1
25.	Cadmium (as Cd)	< 0.01	0.01
26.	Hex. Chromium (as Cr ⁺⁶)	< 0.01	0.05
27.	Selenium (as Se)	< 0.01	0.05
28.	Cyanide (as CN)	< 0.002	0.05
29.	Phenolic Compounds (as C ₆ H ₅ OH)	< 0.002	0.005
30.	Anionic Detergents (as MBAS)	< 0.05	1.0
31.	Total Coliforms	40	5000

SW-3 Samij Nallah Water Before ML area:

The sample after analysis and in comparison with the Standards prescribed in the Surface Water Quality Standard, IS 2296 (Class – C), water used for Drinking with conventional treatment followed by Disinfection is found to be well within the prescribed limits in both the seasons monitored. The results are detailed in **Table No. 6.12**.

Table No: 6.12
Samij Nallah Water (100 m upstream of the ML area)

SI No	Parameters	Six Monthly Average Value	Surface Water Quality Standard as per IS: 2296 (Class C)
1.	Colour	< 5	300
2.	Odour	Agreeable	-
3.	Taste	Agreeable	-
4.	pH Value	6.77	6.5 – 8.5
5.	Electrical Conductivity	86.92	-
6.	Dissolved Oxygen (Min.)	5.97	4
7.	BOD (3 days at 27°C)	2.00	3

SI No	Parameters	Six Monthly Average Value	Surface Water Quality Standard as per IS: 2296 (Class C)
8.	Total Dissolved Solids	56.17	1500
9.	Oil & Grease	< 0.10	0.1
10.	Total Hardness (as CaCO ₃)	40.52	-
11.	Chlorides (as Cl)	11.10	600
12.	Sulfate (as SO ₄)	0.54	400
13.	Total Nitrate (as NO ₃)	< 2.20	50
14.	Free Carbon Dioxide (as CO ₂)	8.51	-
15.	Free Ammonia (as NH ₃)	< 0.012	-
16.	Fluoride (as F)	< 0.05	1.5
17.	Calcium (as Ca)	10.59	-
18.	Magnesium (as Mg)	3.42	-
19.	Copper (as Cu)	< 0.1	1.5
20.	Iron (as Fe)	0.44	50
21.	Manganese (as Mn)	< 0.05	-
21.	Zinc (as Zn)	< 0.02	15
22.	Total Arsenic (as As)	< 0.002	0.2
23.	Mercury (as Hg)	< 0.01	-
24.	Lead (as Pb)	< 0.10	0.1
25.	Cadmium (as Cd)	< 0.01	0.01
26.	Hex. Chromium (as Cr ⁺⁶)	< 0.01	0.05
27.	Selenium (as Se)	< 0.01	0.05
28.	Cyanide (as CN)	< 0.002	0.05
29.	Phenolic Compounds (as C ₆ H ₅ OH)	< 0.002	0.005
30.	Anionic Detergents (as MBAS)	< 0.05	1.0
31.	Total Coliforms	70	5000

SW-4 Samij Nallah Water After ML area:

The sample after analysis and in comparison with the Standards prescribed in the Surface Water Quality Standard, IS 2296 (Class – C), water used for Drinking with conventional treatment followed by Disinfection is found to be well within the prescribed limits in both the seasons monitored. The results are detailed in **Table No. 6.13**.

Table No: 6.13
Samij Nallah Water (100 m Downstream of the ML area)

SI No	Parameters	Six Monthly Average Value	Surface Water Quality Standard as per IS: 2296 (Class C)
1.	Colour	< 5	300
2.	Odour	Agreeable	-
3.	Taste	Agreeable	-
4.	pH Value	6.90	6.5 – 8.5
5.	Electrical Conductivity	92.35	-
6.	Dissolved Oxygen (Min.)	6.08	4
7.	BOD (3 days at 27°C)	1.25	3
8.	Total Dissolved Solids	60.33	1500
9.	Oil & Grease	< 0.10	0.1
10.	Total Hardness (as CaCO ₃)	38.23	-
11.	Chlorides (as Cl)	10.94	600
12.	Sulfate (as SO ₄)	0.72	400
13.	Total Nitrate (as NO ₃)	< 2.20	50
14.	Free Carbon Dioxide (as CO ₂)	6.75	-
15.	Free Ammonia (as NH ₃)	< 0.012	-
16.	Fluoride (as F)	< 0.05	1.5
17.	Calcium (as Ca)	8.62	-
18.	Magnesium (as Mg)	4.06	-

SI No	Parameters	Six Monthly Average Value	Surface Water Quality Standard as per IS: 2296 (Class C)
19.	Copper (as Cu)	< 0.1	1.5
20.	Iron (as Fe)	0.58	50
21.	Manganese (as Mn)	< 0.05	-
21.	Zinc (as Zn)	< 0.02	15
22.	Total Arsenic (as As)	< 0.002	0.2
23.	Mercury (as Hg)	< 0.01	-
24.	Lead (as Pb)	< 0.10	0.1
25.	Cadmium (as Cd)	< 0.01	0.01
26.	Hex. Chromium (as Cr ⁶⁺)	< 0.01	0.05
27.	Selenium (as Se)	< 0.01	0.05
28.	Cyanide (as CN)	< 0.002	0.05
29.	Phenolic Compounds (as C ₆ H ₅ OH)	< 0.002	0.005
30.	Anionic Detergents (as MBAS)	< 0.05	1.0
31.	Total Coliforms	70	5000

SW-5 Kuradihi Nallah Water Before ML area:

The sample after analysis and in comparison with the Standards prescribed in the Surface Water Quality Standard, IS 2296 (Class – C), water used for Drinking with conventional treatment followed by Disinfection is found to be well within the prescribed limits in both the seasons monitored. The results are detailed in **Table No. 6.14**.

Table No: 6.14
Kuradihi Nallah Water (100 m upstream of the ML area)

SI No	Parameters	Six Monthly Average Value	Surface Water Quality Standard as per IS: 2296 (Class C)
1.	Colour	< 5	300
2.	Odour	Agreeable	-
3.	Taste	Agreeable	-
4.	pH Value	7.44	6.5 – 8.5
5.	Electrical Conductivity	161.97	-
6.	Dissolved Oxygen (Min.)	6.07	4
7.	BOD (3 days at 27°C)	1.20	3
8.	Total Dissolved Solids	106.33	1500
9.	Oil & Grease	< 0.10	0.1
10.	Total Hardness (as CaCO ₃)	75.89	-
11.	Chlorides (as Cl)	10.11	600
12.	Sulfate (as SO ₄)	2.65	400
13.	Total Nitrate (as NO ₃)	< 2.20	50
14.	Free Carbon Dioxide (as CO ₂)	5.87	-
15.	Free Ammonia (as NH ₃)	< 0.012	-
16.	Fluoride (as F)	< 0.05	1.5
17.	Calcium (as Ca)	19.14	-
18.	Magnesium (as Mg)	6.84	-
19.	Copper (as Cu)	< 0.1	1.5
20.	Iron (as Fe)	0.45	50
21.	Manganese (as Mn)	< 0.05	-
21.	Zinc (as Zn)	< 0.02	15
22.	Total Arsenic (as As)	< 0.002	0.2
23.	Mercury (as Hg)	< 0.01	-
24.	Lead (as Pb)	< 0.10	0.1
25.	Cadmium (as Cd)	< 0.01	0.01
26.	Hex. Chromium (as Cr ⁶⁺)	< 0.01	0.05
27.	Selenium (as Se)	< 0.01	0.05
28.	Cyanide (as CN)	< 0.002	0.05

SI No	Parameters	Six Monthly Average Value	Surface Water Quality Standard as per IS: 2296 (Class C)
29.	Phenolic Compounds (as C ₆ H ₅ OH)	< 0.002	0.005
30.	Anionic Detergents (as MBAS)	< 0.05	1.0
31.	Total Coliforms	55	5000

SW-6 Kuradihi Nallah Water After ML area:

The sample after analysis and in comparison with the Standards prescribed in the Surface Water Quality Standard, IS 2296 (Class – C), water used for Drinking with conventional treatment followed by Disinfection is found to be well within the prescribed limits in both the seasons monitored. The results are detailed in **Table No. 6.15**.

Table No: 6.15
Kuradihi Nallah Water (100 m Downstream of the ML area)

SI No	Parameters	Six Monthly Average Value	Surface Water Quality Standard as per IS: 2296 (Class C)
1.	Colour	< 5	300
2.	Odour	Agreeable	-
3.	Taste	Agreeable	-
4.	pH Value	7.40	6.5 – 8.5
5.	Electrical Conductivity	149.20	-
6.	Dissolved Oxygen (Min.)	6.10	4
7.	BOD (3 days at 27°C)	1.17	3
8.	Total Dissolved Solids	97.83	1500
9.	Oil & Grease	< 0.10	0.1
10.	Total Hardness (as CaCO ₃)	72.85	-
11.	Chlorides (as Cl)	9.78	600
12.	Sulfate (as SO ₄)	2.63	400
13.	Total Nitrate (as NO ₃)	< 2.20	50
14.	Free Carbon Dioxide (as CO ₂)	5.87	-
15.	Free Ammonia (as NH ₃)	< 0.012	-
16.	Fluoride (as F)	< 0.05	1.5
17.	Calcium (as Ca)	16.96	-
18.	Magnesium (as Mg)	7.42	-
19.	Copper (as Cu)	< 0.1	1.5
20.	Iron (as Fe)	0.56	50
21.	Manganese (as Mn)	< 0.05	-
21.	Zinc (as Zn)	< 0.02	15
22.	Total Arsenic (as As)	< 0.002	0.2
23.	Mercury (as Hg)	< 0.01	-
24.	Lead (as Pb)	< 0.10	0.1
25.	Cadmium (as Cd)	< 0.01	0.01
26.	Hex. Chromium (as Cr ⁺⁶)	< 0.01	0.05
27.	Selenium (as Se)	< 0.01	0.05
28.	Cyanide (as CN)	< 0.002	0.05
29.	Phenolic Compounds (as C ₆ H ₅ OH)	< 0.002	0.005
30.	Anionic Detergents (as MBAS)	< 0.05	1.0
31.	Total Coliforms	70	5000

SW-7 Teherai Nallah Water Before ML area:

The sample after analysis and in comparison with the Standards prescribed in the Surface Water Quality Standard, IS 2296 (Class – C), water used for Drinking with conventional treatment followed by Disinfection is found to be well within the prescribed limits in both the seasons monitored. The results are detailed in **Table No. 6.16**.

Table No: 6.16
Teherai Nallah Water (100 m upstream of the ML area)

SI No	Parameters	Six Monthly Average Value	Surface Water Quality Standard as per IS: 2296 (Class C)
1.	Colour	< 5	300
2.	Odour	Agreeable	-
3.	Taste	Agreeable	-
4.	pH Value	6.62	6.5 – 8.5
5.	Electrical Conductivity	49.92	-
6.	Dissolved Oxygen (Min.)	6.15	4
7.	BOD (3 days at 27°C)	1.33	3
8.	Total Dissolved Solids	32.17	1500
9.	Oil & Grease	< 0.10	0.1
10.	Total Hardness (as CaCO ₃)	24.84	-
11.	Chlorides (as Cl)	8.28	600
12.	Sulfate (as SO ₄)	1.98	400
13.	Total Nitrate (as NO ₃)	< 2.20	50
14.	Free Carbon Dioxide (as CO ₂)	6.16	-
15.	Free Ammonia (as NH ₃)	< 0.012	-
16.	Fluoride (as F)	< 0.05	1.5
17.	Calcium (as Ca)	5.65	-
18.	Magnesium (as Mg)	2.94	-
19.	Copper (as Cu)	< 0.1	1.5
20.	Iron (as Fe)	0.60	50
21.	Manganese (as Mn)	< 0.05	-
21.	Zinc (as Zn)	< 0.02	15
22.	Total Arsenic (as As)	< 0.002	0.2
23.	Mercury (as Hg)	< 0.01	-
24.	Lead (as Pb)	< 0.10	0.1
25.	Cadmium (as Cd)	< 0.01	0.01
26.	Hex. Chromium (as Cr ⁺⁶)	< 0.01	0.05
27.	Selenium (as Se)	< 0.01	0.05
28.	Cyanide (as CN)	< 0.002	0.05
29.	Phenolic Compounds (as C ₆ H ₅ OH)	< 0.002	0.005
30.	Anionic Detergents (as MBAS)	< 0.05	1.0
31.	Total Coliforms	70	5000

SW-8 Teherai Nallah Water After ML area:

The sample after analysis and in comparison with the Standards prescribed in the Surface Water Quality Standard, IS 2296 (Class – C), water used for Drinking with conventional treatment followed by Disinfection is found to be well within the prescribed limits in both the seasons monitored. The results are detailed in **Table No. 6.17**.

Table No: 6.17
Teherai Nallah Water (100 m Downstream of the ML area)

SI No	Parameters	Six Monthly Average Value	Surface Water Quality Standard as per IS: 2296 (Class C)
1.	Colour	< 5	300
2.	Odour	Agreeable	-
3.	Taste	Agreeable	-
4.	pH Value	6.57	6.5 – 8.5
5.	Electrical Conductivity	45.23	-
6.	Dissolved Oxygen (Min.)	6.10	4
7.	BOD (3 days at 27°C)	1.20	3

Sl No	Parameters	Six Monthly Average Value	Surface Water Quality Standard as per IS: 2296 (Class C)
8.	Total Dissolved Solids	29.67	1500
9.	Oil & Grease	< 0.10	0.1
10.	Total Hardness (as CaCO ₃)	25.54	-
11.	Chlorides (as Cl)	9.28	600
12.	Sulfate (as SO ₄)	4.18	400
13.	Total Nitrate (as NO ₃)	< 2.20	50
14.	Free Carbon Dioxide (as CO ₂)	7.04	-
15.	Free Ammonia (as NH ₃)	< 0.012	-
16.	Fluoride (as F)	< 0.05	1.5
17.	Calcium (as Ca)	6.20	-
18.	Magnesium (as Mg)	2.44	-
19.	Copper (as Cu)	< 0.1	1.5
20.	Iron (as Fe)	0.84	50
21.	Manganese (as Mn)	< 0.05	-
21.	Zinc (as Zn)	< 0.02	15
22.	Total Arsenic (as As)	< 0.002	0.2
23.	Mercury (as Hg)	< 0.01	-
24.	Lead (as Pb)	< 0.10	0.1
25.	Cadmium (as Cd)	< 0.01	0.01
26.	Hex. Chromium (as Cr ⁺⁶)	< 0.01	0.05
27.	Selenium (as Se)	< 0.01	0.05
28.	Cyanide (as CN)	< 0.002	0.05
29.	Phenolic Compounds (as C ₆ H ₅ OH)	< 0.002	0.005
30.	Anionic Detergents (as MBAS)	< 0.05	1.0
31.	Total Coliforms	70	5000

GW-1 Mines Office Bore Well

In comparison of the parameters with the prescribed limits of IS 10500, it was found that the water quality is good in both the months but parameter like pH is found to be slightly acidic in both the months. All other parameters are well within the limit. The detail results are given in the **Table No 6.18 & 6.19**.

GW-2 Village Dengula Dug Well. 1

In comparison of the parameters with the prescribed limits of IS 10500, it was found that the water quality is good but parameter like pH is found to be slightly acidic in both the months. The detail results are given in the **Table No 6.18 & 6.19**.

GW-3 Village Raikela Bore Well

In comparison of the parameters with the prescribed limits of IS 10500, it was found that the water quality is good in both the months except the parameter like pH is exceeding the prescribed limits and found to be slightly acidic in both the months. The detail results are given in the **Table No 6.18 & 6.19**.

GW-4 Village Bandhal Dug Well

In comparison of the parameters with the prescribed limits of IS 10500, it was found that the water quality is good in both the months except the parameter like pH is exceeding the prescribed limits and found to be slightly acidic in both the months. The detail results are given in the **Table No 6.18 & 6.19**.

GW-5 Bore Well Near Bottom Weigh Bridge

In comparison of the parameters with the prescribed limits of IS 10500, it was found that the water quality is good except, pH is found to be slightly acidic in both the months. The detail results are given in the **Table No 6.18 & 6.19.**

Table No: 6.18
Ground Water Quality Data for the Month of June

Sl No	Parameters	Sample Collected during month of June					Max. Desirable Limit As per IS 10500:2012
		GW1	GW2	GW3	GW4	GW5	
1.	Colour	< 5	< 5	< 5	< 5	< 5	15
2.	Odour	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
3.	Taste	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
4.	Turbidity	0.3	0.6	4.8	1.8	2.6	5.0
5.	pH Value	5.62	5.56	5.57	5.64	5.75	6.5 – 8.5
6.	Temperature	24.1	24.2	24.2	24.3	24.1	-
7.	Total Hardness (as CaCO ₃)	27.78	27.78	27.78	55.55	19.84	600
8.	Iron (as Fe)	0.10	0.39	0.14	0.18	0.11	0.3
9.	Chlorides (as Cl)	5.96	9.93	5.96	17.86	5.96	1000
10.	Residual Free Chlorine	0.40	0.56	0.36	0.51	0.42	1.0 (min)
11.	Total Dissolved Solids	28	38	32	86	28	2000
12.	Electrical Conductivity	44.8	65.3	48.5	131.7	42.6	-
13.	Calcium (as Ca)	3.18	4.77	6.36	12.72	3.18	200
14.	Magnesium (as Mg)	4.82	3.85	2.89	5.78	2.89	100
15.	Copper (as Cu)	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	1.5
16.	Manganese (as Mn)	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.3
17.	Sulfate (as SO ₄)	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	400
18.	Total Nitrate (as NO ₃)	< 2.20	< 2.20	2.24	5.92	2.24	45
19.	Fluoride (as F)	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	1.5
20.	Cadmium (as Cd)	ND	ND	ND	ND	ND	0.003
21.	Lead (as Pb)	ND	ND	ND	ND	ND	0.01
22.	Arsenic (as As)	ND	ND	ND	ND	ND	0.05
23.	Mercury (as Hg)	ND	ND	ND	ND	ND	0.001
24.	Selenium (as Se)	ND	ND	ND	ND	ND	0.01
25.	Nickel (as Ni)	ND	ND	ND	ND	ND	0.02
26.	Zinc (as Zn)	ND	ND	ND	ND	ND	15.0
27.	Total Chromium (as Cr)	ND	ND	ND	ND	ND	0.05
28.	Total Alkalinity (as CaCO ₃)	20	16	20	36	08	600
29.	Acidity	06	26	02	28	18	-
30.	Sulphide (as H ₂ S)	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	0.05
31.	Sodium (as Na)	1.26	2.12	1.10	6.32	4.63	-
32.	Potassium (as K)	0.54	1.26	0.89	2.40	1.21	-
33.	Total Bacterial Count	Absent	Absent	Absent	Absent	Absent	Absent
34.	E coli	Absent	Absent	Absent	Absent	Absent	Absent

Table No: 6.19
Ground Water Quality Data for the Month of September

SI No	Parameters	Sample Collected during month of September					Max. Desirable Limit As per IS 10500:2012
		GW1	GW2	GW3	GW4	GW5	
1.	Turbidity	0.10	0.6	0.10	0.5	1.80	15
2.	pH Value	6.80	5.86	6.47	6.52	5.88	Agreeable
3.	Total Hardness (as CaCO ₃)	89.76	57.12	44.88	146.88	16.32	Agreeable
4.	Iron (as Fe)	0.36	0.16	0.30	0.24	0.05	5.0
5.	Chlorides (as Cl)	4.99	14.99	8.99	28.99	4.99	6.5 – 8.5
6.	Total Dissolved Solids	98	104	56	216	21	-
7.	Electrical Conductivity	161.1	163.6	90.7	360	34	600
8.	Calcium (as Ca)	31.07	14.72	11.44	27.79	4.91	0.3
9.	Magnesium (as Mg)	2.97	4.96	3.96	18.84	0.99	1000
10.	Copper (as Cu)	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	1.0 (min)
11.	Manganese (as Mn)	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	2000
12.	Sulfate (as SO ₄)	< 0.50	3.44	< 0.50	8.39	< 0.50	-
13.	Total Nitrate (as NO ₃)	< 2.20	< 2.20	< 2.20	5.60	< 2.20	200
14.	Total Alkalinity (as CaCO ₃)	64	56	32	120	08	100
15.	Acidity	46	56	20	36	30	1.5
16.	Sulphide (as H ₂ S)	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	0.3
17.	Sodium (as Na)	3.01	10.20	2.01	12.26	2.01	400
18.	Potassium (as K)	1.29	5.16	1.12	5.41	1.22	45
19.	Fluoride (as F)	< 0.05	< 0.05	< 0.05	0.20	< 0.05	1.5
20.	Cadmium (as Cd)	ND	ND	ND	ND	ND	0.003
21.	Lead (as Pb)	ND	ND	ND	ND	ND	0.01
22.	Arsenic (as As)	ND	ND	ND	ND	ND	0.05
23.	Mercury (as Hg)	ND	ND	ND	ND	ND	0.001
24.	Selenium (as Se)	ND	ND	ND	ND	ND	0.01
25.	Nickel (as Ni)	ND	ND	ND	ND	ND	0.02
26.	Zinc (as Zn)	ND	ND	ND	ND	ND	15.0
27.	Total Chromium (as Cr)	ND	ND	ND	ND	ND	0.05
28.	Colour	< 5	< 5	< 5	< 5	< 5	600
29.	Odour	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	-
30.	Taste	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	0.05
31.	Temperature	27.2	27.9	27.1	26.9	28.1	-
32.	Residual Free Chlorine	0.40	0.24	0.26	0.36	0.08	-
33.	Total Bacterial Count	Absent	Absent	Absent	Absent	Absent	Absent
34.	E coli	Absent	Absent	Absent	Absent	Absent	Absent

5.3 Ground Water Level Data

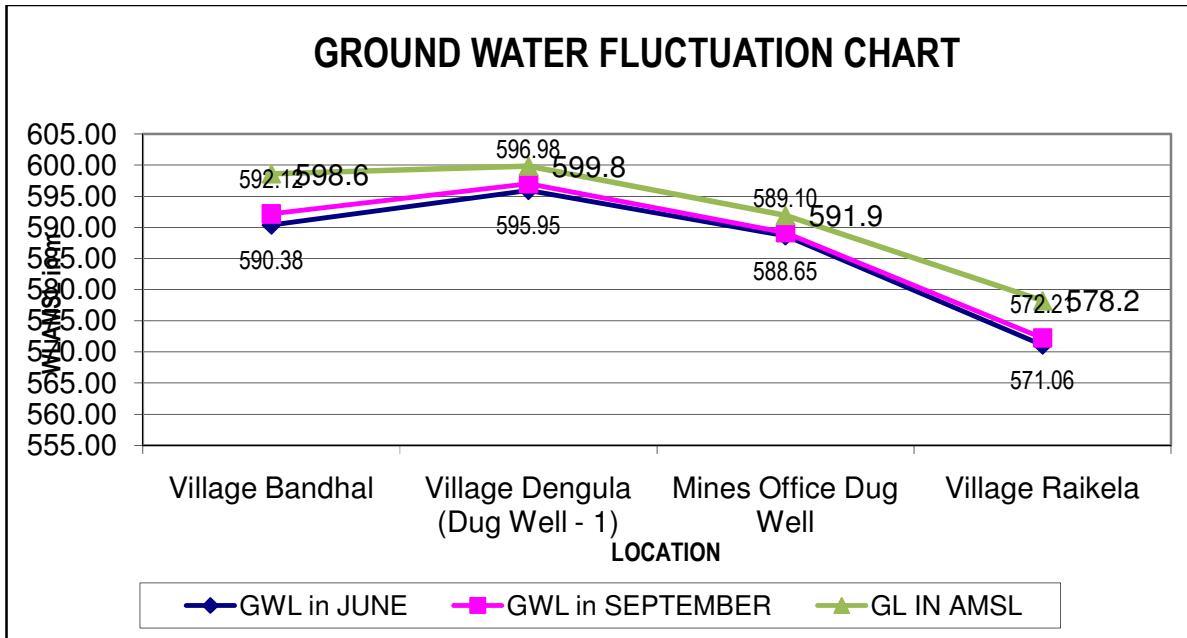
The ground water level measured from the existing dug wells mentioned above are found to be varying significantly i.e. in the month of June the level was found to be low in comparison to the month of September. The detail data is given below in the **Table No 6.20**, with a graphical representation of the fluctuation in **Figure No: 6.10**.

Table No 6.20: Ground Water Level Data

SI No	Location	Ground Level in m AMSL	Ground Water Level in m AMSL		Height of Water Column in m	
			June	September	June	September
1	Village Dengula	599.8	595.95	596.98	4.60	5.63

SI No	Location	Ground Level in m	Ground Water Level in m AMSL		Height of Water Column in m	
	(Dug Well - 1)					
2	Village Bandhal	598.6	590.38	592.12	3.53	5.27
3	Mines Office Dug Well	591.9	588.65	589.10	2.00	2.45
4	Village Raikela	578.2	571.06	572.21	8.91	10.06

Figure No 6.10 : Seasonal Fluctuation of Ground Water Level



5.4 Noise Level Monitoring Data

Noise monitoring was carried out at five different locations of the mine every week. Four more locations were fixed for monitoring of noise level in the buffer zone on monthly basis. The Sound Pressure Level recorded are calculated for Lmin, Lmax, Leq, for HEMM working within the mining area and Lmin, Lmax, Leq Day-time and Leq Night-time for buffer zone locations. All the noise level data from April to September with average Leq values are given in the **Table No 6.21**

N-1 Drilling Machine

The noise level range between 88.8 and 87.5 dB(A) and the average Leq value is 88.0 dB(A) during the study period.

On comparison of the results with Permissible Exposure limits in case of continuous Noise as per OSHA, USA it was found that the noise level is well within the exposure limits.

N-2 Excavator Operator's Cabin

The noise level range between 87.9 and 78.9 dB(A) and the average Leq value is 80.6 dB(A) during the study period.

On comparison of the results with Permissible Exposure limits in case of continuous Noise as per OSHA, USA it was found that the noise level is well within the exposure limits.

N-3 Loader Operator's Cabin

The noise level range between 88.1 and 79.6 dB(A) and the average Leq value is 81.4 dB(A) during the study period.

On comparison of the results with Permissible Exposure limits in case of continuous Noise as per OSHA, USA it was found that the noise level is well within the exposure limits.

N-4 Dumper Operator's Cabin

The noise level range between 82.0 and 79.1 dB(A) and the average Leq value is 80.6 dB(A) during the study period.

On comparison of the results with Permissible Exposure limits in case of continuous Noise as per OSHA, USA it was found that the noise level is well within the exposure limits.

N-5 Working Pit Area during Operation of HEMM

The noise level range between 88.8 and 51.1 dB(A) and the average Leq Day-time value is 55.5 dB(A) during the study period.

On comparison of the results with ambient air quality standards in respect of noise by CPCB, it was found that the ambient noise levels from this location was well within the standards for Industrial area for both day and night time.

N-6 Mines Office Area

The noise level range between 62.9 and 36.5 dB(A) and the average Leq Day-time and Leq Night-time values are 55.5 and 41.0 dB(A) respectively during the study period.

On comparison of the results with ambient air quality standards in respect of noise by CPCB, it was found that the ambient noise levels from this location was well within the standards for Industrial area for both day and night time.

N-7 Village Dengula

The noise level range between 64.1 and 37.3 dB(A) and the average Leq Day-time and Leq Night-time values are 56.7 and 41.3 dB(A) respectively during the study period.

On comparison of the results with ambient air quality standards in respect of noise by CPCB, it was found that the ambient noise levels from this location was well within the standards for Residential area for both day and night time.

N-8 Village Raikela

The noise level range between 64.3 and 37.5 dB(A) and the average Leq Day-time and Leq Night-time values are 56.6 and 41.8 dB(A) respectively during the study period.

On comparison of the results with ambient air quality standards in respect of noise by CPCB, it was found that the ambient noise levels from this location was well within the standards for Residential area for both day and night time.

N-9 Village Bandhal

The noise level range between 61.5 and 36.9 dB(A) and the average Leq Day-time and Leq Night-time values are 55.0 and 41.1 dB(A) respectively during the study period.

On comparison of the results with ambient air quality standards in respect of noise by CPCB, it was found that the ambient noise levels from this location was well within the standards for Residential area for both day and night time.

Table No: 6.21
Noise Level Data from April to September

MONTHS OF APRIL 2021 - SEPTEMBER 2021							
DRILL MACHINE	APR	MAY	JUNE	JULY	AUG	SEPT	AVERAGE VALUE
Leq dB(A)	87.8	88.1	88.2	87.8	88.1	88.2	
Leq dB(A)	87.8	88.2	88.8	87.8	88.1	87.8	
Leq dB(A)	87.7	87.7	87.7	87.9	87.5	87.9	
Leq dB(A)	88.5	87.9	87.9	88.4	87.9	88.3	
Average Leq dB(A)	88.0	88.0	88.2	88.0	87.9	88.1	88.0
Lmax	88.5	88.2	88.8	88.4	88.1	88.3	88.8
Lmin	87.7	87.7	87.7	87.8	87.5	87.8	87.5
EXCAVATOR OPERATOR CABIN	APR	MAY	JUNE	JULY	AUG	SEPT	AVERAGE VALUE
Leq dB(A)	78.9	79.6	79.3	81.9	80.9	80.1	
Leq dB(A)	80.2	79.0	79.7	79.7	87.9	80	
Leq dB(A)	79.9	79.6	80	78.9	82.7	81.8	
Leq dB(A)	80.5	80.2	80.1	80.3	81.8	81	
Average Leq dB(A)	79.9	79.6	79.8	80.2	83.3	80.7	80.6
Lmax	80.5	80.2	80.1	81.9	87.9	81.8	87.9
Lmin	78.9	79.0	79.3	78.9	80.9	80.0	78.9
LOADER OPERATOR CABIN	APR	MAY	JUNE	JULY	AUG	SEPT	AVERAGE VALUE
Leq dB(A)	81.2	79.6	80.7	80.8	82.5	80.8	
Leq dB(A)	80.7	79.8	79.7	81.4	80.9	80.2	
Leq dB(A)	81	80.4	82.6	82.6	80.6	82.1	
Leq dB(A)	82	82.1	80.1	88.1	81.2	81.4	
Average Leq dB(A)	81.2	80.5	80.8	83.2	81.3	81.1	81.4
Lmax	82.0	82.1	82.6	88.1	82.5	82.1	88.1
Lmin	80.7	79.6	79.7	80.8	80.6	80.2	79.6
DUMPER OPERATOR CABIN	APR	MAY	JUNE	JULY	AUG	SEPT	AVERAGE VALUE
Leq dB(A)	80	79.8	79.6	80.7	79.4	81	
Leq dB(A)	80.7	79.9	79.2	79.1	82	80.4	
Leq dB(A)	80.4	81.5	82	81	81	82	
Leq dB(A)	80.6	81.4	79.5	79.5	81.6	81.4	
Average Leq dB(A)	80.4	80.7	80.1	80.1	81.0	81.2	80.6
Lmax	80.7	81.5	82.0	81.0	82.0	82.0	82.0
Lmin	80.0	79.8	79.2	79.1	79.4	80.4	79.1
MINES WORKING AREA	APR	MAY	JUNE	JULY	AUG	SEPT	AVERAGE VALUE
Leq dB(A)	56	56.7	56	56.3	55.7	56.5	
Leq dB(A)	56	54.6	56.7	55.7	55.9	62.4	
Leq dB(A)	56	56.1	55.7	56.2	56.4	51.1	
Leq dB(A)	55.9	56.1	56.1	55.8	65.3	88.8	
Average Leq dB(A)	56.0	55.9	56.1	56.0	58.3	50.9	55.5

MONTHS OF APRIL 2021 - SEPTEMBER 2021							
Lmax	56.0	56.7	56.7	56.3	65.3	88.8	88.8
Lmin	55.9	54.6	55.7	55.7	55.7	51.1	51.1
MINES OFFICE AREA	APR	MAY	JUNE	JULY	AUG	SEPT	AVERAGE VALUE
Leq Day Time dB(A)	55.2	57	56.4	52.2	52.4	59.7	55.5
Leq Night Time dB(A)	42	41.4	40.1	40.1	36.9	45.7	41.0
Lmax	63.6	64.2	64.1	58.6	58.2	68.7	62.9
Lmin	38.2	37.7	36.8	36.7	34.2	35.4	36.5
VILLAGE DENGULA	APR	MAY	JUNE	JULY	AUG	SEPT	AVERAGE VALUE
Leq Day Time dB(A)	53.3	54.3	53.1	59.6	59.6	60.2	56.7
Leq Night Time dB(A)	43.4	41.5	38.1	36.4	42.9	45.5	41.3
Lmax	58.1	63.2	59.3	67.7	68.7	67.4	64.1
Lmin	38.1	39.5	35.4	34.7	34.7	41.5	37.3
VILLAGE RAIKELA	APR	MAY	JUNE	JULY	AUG	SEPT	AVERAGE VALUE
Leq Day Time dB(A)	55.8	54.7	53.7	61.5	56.8	57.2	56.6
Leq Night Time dB(A)	43	39.9	40.7	44	40.6	42.5	41.8
Lmax	64.0	61.6	61.9	68.7	64	65.3	64.3
Lmin	37.5	37.7	34.7	36.7	38.7	39.9	37.5
VILLAGE BANDHAL	APR	MAY	JUNE	JULY	AUG	SEPT	AVERAGE VALUE
Leq Day Time dB(A)	54.8	56.7	53.4	50	57.5	57.5	55.0
Leq Night Time dB(A)	41.3	43.6	44.5	33	42.1	42.1	41.1
Lmax	62.7	61.3	58.4	57.8	64.5	64.5	61.5
Lmin	37.9	40.8	30.6	30.9	40.5	40.5	36.9

5.5 Soil Quality Monitoring Data

Soil was collected from two locations during the month of June. The analysis data reveals that the soil quality is good in both the locations. Soil is acidic near OB dump area. Iron content of the soil is on the higher side which is very much natural for the kind of soil. Phosphorus, Available Potassium & Organic Matter content of the soil is on the lower side for soil near OB dump. All other parameters are good. All the data are given in detail in the **Table No 6.22**.

Table No 6.22
Soil Quality Data in the Month of June

Sl. No.	Parameter	Method of Analysis	Unit	S1	S2
1.	pH (1:2 Suspension)	IS:2720 (Part 26): 1987, RA 2016	-	5.88	7.25
2.	Electrical Conductivity	IS 14767: 2000, RA 2016	μS/cm	147	259
3.	Available Nitrogen (as N)	CPL/SOP/03/N, Issue No: 03, Dtd.: 23.10.2107	Kg/ha	87.81	137.98
4.	Available Phosphorous (as P ₂ O ₅)	CPL/SOP/03/P, Issue No: 03, Dtd.: 23.10.2107	Kg/ha	3.86	36.0
5.	Available Potassium (as K ₂ O)	CPL/SOP/03/K, Issue No: 03, Dtd.: 23.10.2107	Kg/ha	2.51	532.68
6.	Organic Carbon	IS 2720 (Part 22), 1972 - RA 2015	%	0.25	2.54

Sl. No.	Parameter	Method of Analysis	Unit	S1	S2
7.	Organic Matter	IS 2720 (Part 22), 1972 - RA 2015	%	0.43	4.38
8.	Available Iron (as Fe)	CPL/SOP/03/Fe, Issue No: 03, Dtd.: 23.10.2107 Methods Manual Soil Testing in India, Department of Agriculture & Cooperation, Ministry of Agriculture, Government of India, January, 2011	mg/kg	11.68	8.32
9.	Available Manganese (as Mn)	CPL/SOP/03/Mn, Issue No: 03, Dtd.: 23.10.2107 Methods Manual Soil Testing in India, Department of Agriculture & Cooperation, Ministry of Agriculture, Government of India, January, 2011	mg/kg	4.01	2.18

6.0 CONCLUSION

6.1 Ambient Air Quality

It is concluded from the above study that the overall ambient air quality of the Raikela & Tantra Iron Ore Mines of Penguin Trading & Agencies Ltd. is good and the action taken by the mines authority were quite satisfactory. No results in the core as well as buffer are exceeding the prescribed limit.

6.2 Fugitive Dust Emission Monitoring

It is concluded from the above study that the fugitive dust emission from the five locations monitored at the Raikela & Tantra Iron Ore Mines of Penguin Trading & Agencies Ltd. is good and the action taken by the mines authority were quite satisfactory. No results are exceeding the prescribed limit of 1200 µg/m³ as per MOEF notification dated 4th October 2010 for Iron Ore mining operations.

6.3 Water Quality

The surface water quality of all the locations monitored are found to be well within the prescribed standards as per IS 2296 (Class – C) and the ground water quality of the entire area was also good except pH, which was found to be slightly acidic and less than 6.5.

6.4 Ground Water Level

There is no problem in the availability ground water of the area.

6.5 Noise level

Noise monitoring results show that noise levels are well within the limits at all the stations, and there is no problem in the area due to noise from the mining activity.

6.6 Soil Quality

Soil quality results show that both the locations have good quality soil and there is no contamination done due to mining activity.

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