**CHAPTER 1**

**COMPLIANCE OF STIPULATED CONDITIONS OF ENVIRONMENTAL CLEARANCE**

|  |  |  |
| --- | --- | --- |
| **S.No.** | **Description** | **Compliance** |
| **PART A: SPECIFIC CONDITIONS** |
| i) | The National Ambient Air Quality Emission Standards issued by the Ministry vide G.S.R. No. 826 (E) dated 16th November, 2009 shall be followed. | Agreed and shall be complied with. |
| ii) | As proposed, no flue gas emitting device/equipment shall be installed. | No flue gas emitting device has been installed. |
| iii) | In plant control measures for checking fugitive emissions from all the vulnerable sources shall be provided. Adequate dust suppression system with water spray shall be provided for storage yard, junction houses.Raw material loading and unloading areas shall be covered and also provided with water spraying system. Fugitive emission in the work zone environment, products, raw material storage etc. shall be regularly monitored and records maintained. The emission shall conform to the limits stipulated by the Uttarakhand Environment Protection & Pollution Control Board (UEP & PCB) | Fugitive dust management is done properly by water sprinkling. |
| iv) | For further control of fugitive emission, following steps shall be followed –1. Closed handling system shall be provided for chemicals.
2. Reflux condenser shall be provided over reactor.
3. System of leak detection and repair of pump/pipeline based on preventive maintenance.
4. The acids shall be taken from storage tanks to reactors through closed pipeline. Storage tanks shall be vented through tap receiver condenser operated on chilled water.
5. Cathodic protection shall be provided to the underground storage tank.
 | Agreed and shall be complied with. |
| v) | The gaseous emissions from DG sets shall be dispersed through adequate stack height as per CPCB standards. Acoustic enclosures shall be provided to the DG sets to mitigate the noise pollution. | Agreed. Stack height shall be as per CPCB standards so that the gaseous emissions are dispersed through adequate stack height.All the DG sets shall be provided with acoustic enclosures to mitigate the noise pollution. |
| vi) | The company shall upload the status of compliance of stipulated environmental clearance conditions including the results of the monitored data on its website and shall update the same periodically. It shall simultaneously be sent to the Regional Office of MoEFCC, the respective zonal office of CPCB and the UEP&PCB. The levels of PM10, SO2, NOX, CO and VOC’s in the ambient air shall be monitored and displayed at the convenient location near the main gate of the company and an important public place. | Monitoring reports with regard to compliance of EC conditions are being sent to the Zonal office, CPCB and the UEP & PCB.The compliance report has been uploaded on company website regularly.The results of monitored data has been displayed on board near main gate. |
| vii) | Solvent management shall be carried out as follows –1. Reactor shall be connected to the chilled brine condenser system.
2. Reactor and solvent handling pump shall have mechanical seals to prevent leakage.
3. The condenser shall be provided with sufficient HTA and residence time so as to achieve more than 95% recovery.
4. Solvent shall be stored in a separate space specified with all safety measures.
5. Proper earthing shall be provided in all the electrical equipment whenever solvent handling is done.
6. Entire plant shall be flame proof and solvent storage tank should be provided with breather valve to prevent losses.
 | Agreed. All the solvent management measures shall be followed. |
| viii) | Total fresh water requirement from ground water source shall not exceed 4.0 m3/day and prior permission shall be obtained from Central Ground Water Authority/State Ground Water Board and copy of permission shall be submitted to the Ministry’s Regional office at Lucknow. | Agreed. Total fresh water requirement from ground water source shall not exceed 4.0 m3/dayWe have applied for the permission of Ground Water Withdrawal from Central Ground Water Authority vides Application Number-21-4/1090/UT/IND/2018 on dated 29.10.2018. |
| ix) | As proposed, no industrial effluent shall be generated. Domestic wastewater shall be disposed through septic tank and soak pit. | Agreed. No industrial effluent shall be generated and the domestic waste water shall be disposed through septic tank and soak pit. |
| x) | During transfer of materials, spillages shall be avoided and garland drains should be constructed to avoid mixing of accidental spillages with domestic waste and storm water drains. | Agreed. Spillages shall be avoided during transfer of materials and garland drains shall be constructed to avoid mixing of accidental spillages with domestic waste and storm water drains. |
| xi) | The Company shall strictly comply with the rules and guidelines under Manufacture, Storage and Import of Hazardous Chemicals (MSIHC) Rules, 1989 as amended time to time. All transportation of hazardous chemicals shall be as per the Motor Vehicle Act (MVA), 1989. | Agreed and shall be complied with. |
| xii) | The company shall undertake following waste minimization measures:1. Metering and control of quantities of active ingredients to minimize waste.
2. Reuse of byproducts from the process as raw materials or as raw material substitutes in other processes.
3. Use of automated filling to minimize spillage.
4. Use of Close Feed System into batch reactors.
5. Venting equipment through vapour recovery system.
6. Use of high pressure hoses for equipment clearing to reduce wastewater generation.
 | Agreed and shall be complied with. |
| xiii) | The unit shall make the arrangement for protection of possible fire hazards during manufacturing process in material handling. Fire fighting system shall be as per the OISD 117 norms. | Agreed. Necessary arrangements shall be made for theprotection of possible fire hazards during manufacturing process in material handling. |
| xiv) | Occupational health surveillance of the workers shall be done on a regular basis and records maintained as per the Factories Act. | Agreed. Occupational health surveillance shall be regularly done on a regular basis. |
| xv) | Greenbelt shall be developed in 360m2 out of 1090 m2 as per guidelines of CPCB. | Agreed. The total plot area of the project is 1090 Sq. meter. Green Belt has been developed at project site.We ensure you that green belt will be developed in 33% of total plot area as per the guidelines of CPCB within eight months. |
| xvi) | Provision shall be made for the housing for the construction labor within the site with all necessary infrastructure and facilities such as fuel for cooking, mobile toilets, mobile sewage treatment plant, safe drinking water, medical healthcare, crèche etc. The housing may be in the form of temporary structure to be removed after the completion of the project. All the construction wastes shall be managed so that there is no impact on the surrounding environment. | The construction labor shall be hired from local areas so there is no need for temporary housing structures.The necessary facilities such as drinking water, medical healthcare facilities, toilets etc. shall be made available in the premises. |
| **PART B: GENERAL CONDITIONS**  |
| i) | The project authorities shall strictly adhere to the stipulations made by the Uttarakhand Environment Protection & Pollution Control Board. | Agreed and shall be complied with. |
| ii) | No further expansion or modifications in the plant shall be carried out without prior approval of the Ministry of Environment and Forests. In case of deviations or alterations in the project proposal from those submitted to this Ministry for clearance, a fresh reference shall be made to the Ministry to assess the adequacy of conditions imposed and to add additional environmental protection measures required, if any. | Agreed. No further expansion or modifications in the plant shall be carried out without prior approval of the Ministry of Environment, Forests & Climate Change (MoEFCC). |
| iii) | The locations of ambient air quality monitoring stations shall be decided in consultation with the State Pollution Control Board (SPCB) and it shall be ensured that at least one stations is installed in the upwind and downwind direction as well as where maximum ground level concentrations are anticipated. | Agreed. A Request letter to select the Locations for Ambient Air Quality Monitoring stations and ensuring that at least one location in Upwind direction and one location in downwind direction as well as where maximum ground level concentrations are anticipated has been written to Regional Officer, Uttarakhand Environment Protection & Pollution Control Board, Roorkee on dated 26.10.2018. We ensure you that we will follow the instructions given by UEP&PCB, Roorkee at the time of Environmental Monitoring in future. |
| iv) | The overall noise levels in and around the plant area shall be kept well within the standards by providing noise control measures including acoustic hoods, silencers, enclosures etc. on all sources of noise generation. The ambient noise levels shall conform to the standards prescribed under Environment (Protection) Act, 1986 Rules, 1989 viz. 75 dBA (daytime) and 70 dBA (night time)  | Agreed. The overall noise levels in and around the plant area shall be kept well within the standards by providing noise control measures including acoustic hoods, silencers, enclosures etc. on all sources of noise generation.The ambient noise levels shall conform to the standards prescribed under Environment (Protection) Act, 1986 Rules, 1989 viz. 75 dBA (daytime) and 70 dBA (night time) Details are given in the attached monitoring reports. |
| v) | The Company shall harvest rainwater from the roof tops of the buildings and storm water drains to recharge the ground water and use the same water for the process activities of the project to conserve fresh water. | Rainwater harvesting pits are made for recharging ground water and other activities.As we have applied for the permission of Ground Water Withdrawal from Central Ground Water Authority vide Application Number-21-4/1090/UT/IND/2018 on dated 29.10.2018.We will implement the rain water harvesting plan within six months. |
| vi) | Training shall be imparted to all employees on safety and health aspects of chemical handling. Pre employment and routine periodical medical examinations for all employees shall be undertaken on regular basis. Training to all employees on handling of chemicals shall be imparted. | Agreed. Training shall be imparted to all employees on safety and health aspects of chemical handling. Pre employment and routine periodical medical examinations for all employees shall be undertaken on regular basis. |
| vii) | Usage of Personnel Protection Equipments (PPE’s) by all employees/workers shall be ensured. | Agreed. It shall be ensured that all employees/workers use PPE’s. |
| viii) | The Company shall also comply with all the environmental protection measures and safeguards proposed in the documents submitted to the Ministry. All the recommendations made in the EIA/EMP in respect of environmental management, risk mitigation measures and public hearing relating to the project shall be implemented. | Agreed. We shall comply with all the environmental protection measures and safeguards proposed in the documents submitted to the Ministry. All the recommendations made in the EIA/EMP in respect of environmental management, risk mitigation measures and public hearing relating to the project shall be implemented. |
| ix) | The Company shall undertake all relevant measures for improving the socio economic conditions of the surrounding area. CSR activities shall be undertaken by involving local villages and administration.  | Agreed and shall be complied with.We have constructed a toilet at village-Karondi, Bhagwanpur under CSR Activity.We shall improve the social, economical and ecological status of surrounding villages in consultation with villagers. |
| x) | The Company shall undertake eco developmental measures including community welfare measures in the project area for the overall improvement of the environment. | Agreed. Plantation has been done at the project site and at Shiv Ganga Industrial Head Office. All the liquid effluents have been treated in Effluent treatment plant. We have provided the Personnel protective equipments to the workers. We ensure you that; we will adopt more eco-developmental measures including community welfare measures within six months.The Company shall undertake eco developmental measures including community welfare measures in the project area for the overall improvement of the environment. |
| xi) | A separate Environmental Management Cell equipped with full fledged laboratory facilities shall be set up to carry out the Environmental Management and Monitoring functions. | Laboratory facility has been set up at the project site. We have also hired Idma Laboratories Limited for regular monitoring of Ambient Air Quality, Ambient Noise Quality, Soil and Water Quality, ETP Water Quality Monitoring. |
| xii) | The company shall earmark sufficient funds towards capital cost and recurring cost/annum to implement the conditions stipulated by the Ministry of Environment & Forests as well as the State Government along with the implementation schedule for all the conditions stipulated herein. The funds so earmarked for the environment management/pollution control measures shall not be diverted for any other purpose. | Agreed.The details of Funds earmarked for the environment management/Pollution control measures has already been submitted to MoEF&CC, New Delhi. |
| xiii) | A copy of the clearance letter shall be sent by the project proponent to the concerned Panchayat, Zila Parishad/Municipal Corporation, Urban local body and the local NGO, if any, were received while processing the proposal. | Agreed and shall be complied with. |
| xiv) | The Project Proponent shall also submit six monthly reports on the status of compliance of the stipulated Environmental Clearance conditions including results of monitored data (both in hard copies as well as by email) to the respective Regional Office of the MoEFCC, the respective Zonal office of CPCB and the UEP & PCB. A copy of Environmental Clearance and six monthly compliance status reports shall be posted on the website of the Company. | We are regularly submitting six monthly compliance reports along with environment monitoring reports to the Ministry of Environment, Forests & Climate Change, its regional office at Chandigarh, respective zonal office of CPCB, SPCB. |
| xv) | The Environmental statement for each financial year ending 31st March in Form V as is mandated shall be submitted to the concerned State Pollution Control Board as prescribed under the Environment (Protection) Rules, 1986, as amended. Subsequently, shall also be put up on the website of the Company along with the status of compliance of environmental clearance conditions and shall also be sent to the respective regional offices of MoEFCC by email. | Agreed and shall be complied with. |
| xvi) | The Project Proponent shall inform the public that the project has been accorded environmental clearance by the Ministry and copies of the Clearance Letter are available with the SPCB/Committee and may also be seen at the Website of the Ministry at <http://envfor.nic.in>. This shall be advertised within seven days from the date of issue of the clearance letter, at least in two local newspapers that are widely circulated in the region of which one shall be in vernacular language of the locality concerned and a copy of the same shall be forwarded to the Concerned regional office of the Ministry. | Agreed and shall be complied with. |
| xvii) | The project authorities shall inform the regional office as well as the Ministry, the date of financial closure and final approval of the project by the concerned authorities and the date of start of the project. | Agreed.  |

**CHAPTER 2**

**Details of Environmental Monitoring**

**2.0 INTRODUCTION**

M/s Focus Polymers & Emulsions Pvt. Ltd. was granted its Environmental Clearance letter from Ministry of Environment, Forests and Climate Change vide letter no. F.No. J-11011/227/2010-IA II (I) for Lamination Adhesive (2.0 MTPD) and Pressure Sensitive Adhesive (2.0 MTPD) Manufacturing Unit at Plot No. 12, Khasra no. 115 Ka, 115 GHA, Shiv Ganga Industrial Estate, Village- Lakashwari, Tehsil-Roorkee, District-Haridwar, Uttarakhand.

**2.1 AMBIENT AIR QUALITY MONITORING**

**2.1.1 Ambient Air Quality Monitoring Stations**

Ambient air quality monitoring has been carried out at 6 locations as mentioned below**.** This will enable to have a comparative analytical understanding about air quality and the changes in the air environment in the study area with respect to the condition prevailing. The locations of the ambient air quality monitoring stations are given in **Table 2.1**.

**Table 2.1 Details of Ambient Air Quality Monitoring Stations**

|  |  |  |
| --- | --- | --- |
| **S. No.** | **Location Code** | * 1. **Location Name/ Description**
 |
| 1. | AAQ-1 | Project Site |
| 2. | AAQ-2 | Khubanpur Village  |
| 3. | AAQ-3 | Bhagwanpur Village  |
| 4. | AAQ-4 | Industrial Area Bhagwanpur |
| 5. | AAQ-5 | Near Main Gate  |

**2.1.2 Ambient Air Quality Monitoring Methodology**

Monitoring was conducted in respect of the following parameters:

* Particulate Matter (PM10)
* Sulphur Dioxide (SO2)
* Nitrogen Dioxide (NO2)

The duration of sampling of PM10, SO2 , and NO2 was 24 hourly continuous sampling per day. The monitoring was conducted for one day at each location. This is to allow a comparison with the National Ambient Air Quality Standards.

The air samples were analyzed as per standard methods specified by Central Pollution Control Board (CPCB) and IS: 5182. The techniques used for ambient air quality monitoring and minimum detectable levels are given in **Table 2.2**.

**Table 2.2 Techniques used for Ambient Air Quality Monitoring**

|  |  |  |  |
| --- | --- | --- | --- |
| **S. No.** | **Parameter** | **Technique** | **Technical Protocol** |
| 1. | Particulate Matter (PM10 ) | Respirable Dust Sampler with cyclone separator, Gravimetric method | IS-5182 (Part -23), 2006 |
| 2. | Sulphur Dioxide | Modified West and Gaeke | IS-5182 (Part II), 2001 |
| 3. | Oxides of Nitrogen | Jacob & Hochheiser | IS-5182 (Part VI), 2006 |

**2.1.3 Ambient Air Quality Monitoring Results**

The detailed on-site monitoring results of PM10, SO2 and NO2 are presented in **Table 2.3**.

**Table 2.3 Ambient Air Quality Monitoring Results**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **S. No.** | **Parameter** | **Unit** | **Test Result** | **Test Methods** |  **Prescribed Standard** |
| AAQ1 | AAQ2 | AAQ3 | AAQ4 | AAQ5 |
| 1. | Particulate Matter (PM10) | μg/m3 | 76.3 | 79.6 | 75.4 | 78.3 | 80.2 | NAAQMS/36/2012-13 | 100 |
| 2. | Sulphur Dioxide(SO2) | μg/m3 | 15.86 | 17.44 | 15.71 | 16.28 | 17.06 | NAAQMS/36/2012-13 | 80 |
| 3. | Nitrogen Dioxide (NO2) | μg/m3 | 19.24 | 21.85 | 19.36 | 20.52 | 20.84 | NAAQMS/36/2012-13 | 80 |

**2.1.4 Discussion on Ambient Air Quality in the Study Area**

PM10 levels at the project site do not exceed the permissible limit of 100 μg/m3 (for residential, rural and other areas as stipulated in the National Ambient Air Quality Standards). Whereas SO2, NO2 was observed within the corresponding stipulated limits (Limit for SO2 is 80 μg/m3 and NO2 is 80 μg/m3) at all monitoring locations.

**Table 2.4 Details of D.G. Stack Emission Monitoring Stations**

|  |  |  |
| --- | --- | --- |
| **S. No.** | **Location Code** | * 1. **Location Name/ Description**
 |
| 1. | D.G-1 | D.G. Cummins at project site |

**Table 2.5 D.G. Set Stack Emissions**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **S.no.** | **Test Parameter** | **Units** | **Results** | **Standards (Max)** | **Test Method** |
| 1. | Particulate Matter | g/Kw-hr | 0.15 | Max. 0.3 | USEPA Method 10,10A |
| 2. | Carbon monoxide | g/Kw-hr | 1.73 | Max. 3.5 | USEPA Method 10,10A |
| 3. | NOX+HC | g/Kw-hr | 2.97 | Max. 4.7 | USEPA Method 7E |
| 4. | Sulphur Dioxide | g/Kw-hr | 1.32 | - | USEPA Method 6C |

**Table 2.6 Details of Boiler Stack Emission Monitoring Stations**

|  |  |  |
| --- | --- | --- |
| **S. No.** | **Location Code** | * 1. **Location Name/ Description**
 |
| 1. | Boiler-1 | Boiler at project site  |

**Table 2.7 Boiler Stack Emissions**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **S.no.** | **Test Parameter** | **Units** | **Results** | **Standards (Max)** | **Test Method** |
| 1. | Particulate Matter | mg/Nm3 | 48.4 | <150 | USEPA Method 10,10A |
| 2. | Carbon Monoxide | mg/Nm3 | 28 | - | USEPA Method 10,10A |
| 3. | Nitrogen Dioxide | mg/Nm3 | 21.2 | - | USEPA Method 7E |
| 4. | Sulphur Dioxide | mg/Nm3 | 9.6 | - | USEPA Method 6C |

**2.2 AMBIENT NOISE MONITORING**

**2.2.1 Ambient Noise Monitoring Locations**

The main objective of noise monitoring in the study area is to assess the present ambient noise levels in project site & project boundary due to various construction allied activities and increased vehicular movement. A preliminary reconnaissance survey has been undertaken to identify the major noise generating sources in the area. Ambient noise monitoring was conducted at the boundary of the project site as given in **Table 2.8**.

**Table 2.8 Details of Ambient Noise Monitoring Stations**

|  |  |  |
| --- | --- | --- |
| **S. No.** | * + - * 1. **Location Code**
 | **Location Name/ Description** |
|  | N1 | Project Site |
|  | N2 | Khubanpur Village  |
|  | N3 | Bhagwanpur Village  |
|  | N4 | Industrial Area Bhagwanpur |
|  | N5 | Near Main Gate  |

**2.2.2 Methodology of Noise Monitoring**

Noise levels were measured using sound level meter. Noise level monitoring was carried out continuously for 24-hours with one hour interval starting at 6:00AM to 6:00 AM of next day. The noise levels were monitored on working days only. During each hour Leq were directly computed by the instrument based on the sound pressure levels. Lday (Ld) and Lnight (Ln). Monitoring was carried out at ‘A’ response and fast mode.

**2.2.3 Ambient Noise Monitoring Results**

The location wise ambient noise monitoring results is summarized in **Table 2.9.**

**Table 2.9 Ambient Noise Monitoring Results**

|  |  |  |  |
| --- | --- | --- | --- |
| **S.No** | **Location** | **Parameters** | **CPCB limits in dB(A) Leq (Industrial: Day – 75.00,****Night-70.00)****(Residential: Day - 55.00****Night-45.00)** |
|  |  | **\*Day Time** | **\*\*Night Time** |  |
|  |  | **Lday** | **Lnight** |  |
|  | Project Site | 68.2 | 54.8 | (Industrial: Day – 75.00,Night-70.00) |
|  | Khubanpur Village  | 50.1 | 40.7 | (Residential: Day - 55.00;Night-45.00) |
|  | Bhagwanpur Village  | 49.3 | 40.1 | (Residential: Day - 55.00;Night-45.00) |
|  | Industrial Area Bhagwanpur | 67.5 | 55.8 | (Industrial: Day – 75.00,Night-70.00) |
|  | Near Main Gate  | 68.3 | 56.2 | (Industrial: Day – 75.00,Night-70.00) |

***\*Day Time = 6:00AM to 10:00PM***

***\*\* Night Time = 10:00PM to 6:00AM***

**2.2.4 Discussion on Ambient Noise Levels in the Study Area**

1. **Day Time Noise Levels (Lday):**

The day time noise level at all the locations were found to within limits prescribed for Residential area i.e. 55 dB (A) and Industrial area i.e. 75 dB (A).

1. **Night Time Noise Levels (Lnight):**

The night time noise level at all the locations were found to within limit prescribed for Residential area i.e. 45 dB (A) and Industrial area i.e. 70 dB (A).

**2.3 WATER QUALITY MONITORING**

**2.3.1 Water Quality Monitoring Locations**

Keeping in view the importance of groundwater as an important source of drinking water to the local population, sample of ground water was collected from the project site for the assessment of impacts of the project on the groundwater quality.

Water sample was collected from four locations. The sample was analyzed for various parameters to compare with the standards for drinking water as per IS: 10500. The details of ground water sampling locations are given in **Table 2.10** and details of Waste water sampling location are given in **Table 2.16.**

**Table 2.10. Details of Water Quality Monitoring Station**

|  |  |  |
| --- | --- | --- |
| **S. No.** | * + - * 1. **Location Code**
 | **Location Name/ Description** |
| 1. | GW 1  | Project Site |
| 2. | GW 2 | Khubanpur Village |
| 3. | GW 3 | Bhagwanpur Village  |
| 4. | GW 4 | Industrial Area Bhagwanpur  |
| 5. | GW 5 | Near Main Gate |

**2.3.2 Methodology of Water Quality Monitoring**

Sampling of ground water was carried out on March 2019. Samples were collected as grab sample and sampling forms are filled in as per the sampling plan. The preservative sample were properly added to preserve as per standard operating procedures (SOP) and stored immediately in ice boxes, which were ensured for appropriate temperatures. Sample for chemical analysis was collected in polyethylene carboys. Sample collected for metal content were acidified to <2 pH with 1 ml HNO3. A sample for bacteriological analysis was collected in sterilized glass bottles.

Soon after the completion of sampling, chain of custody sheets for the samples are filled in and then they were transported by road to M/s. Idma Laboratories Ltd. for further analysis. Proper care was taken during packing and transportation of samples. After ensuring the same the samples were forwarded immediately for analysis.

The samples were analyzed as per the standard procedures specified in 'Standard Methods for the Examination of Water and Wastewater' published by American Public Health Association (APHA) and CPCB.

**2.3.3 Ground Water Quality Monitoring Results**

The detailed groundwater quality monitoring results are presented in **Table 2.11**

**Table 2.11 Ground Water Quality Monitoring Results at Project Site**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **S. No** | **Substance or Characteristic** | **Units** | **Result** | **Requirements** | **Methods of Test** |
| **Requirement (Desirable Limit)** | **Permissible Limit in the Absence of Alternate Source** |
| 1. | Colour | Hazen  | <1 | Max. 5 | 15 | APHA 2120 B&C 23rd Edition,2017 |
| 2. | Odour | Qualitative | Agreeable | Agreeable | Agreeable | APHA 2150 B 23rd Edition,2017 |
| 3. | pH value | - | 7.62 | 6.5 to 8.5 | No Relaxation | APHA 4500H+B 23rd Edition,2017 |
| 4. | Alkalinity as HCO3 | mg/L | 185 | 200 | 600 | APHA 2320 B 23rd Edition,2017 |
| 5. | Boron | mg/L | <0.01 | 0.5 | 1.0 | APHA 3125 B 23rd Edition,2017 |
| 6. | Calcium as Ca | mg/L | 34.4 | 75 | 200 | APHA 3500-Ca B 23rd Edition,2017 |
| 7. | Chloride as Cl | mg/L | 20 | 250 | 1000 | APHA 4500 Cl-B 23rd Edition,2017 |
| 8. | Conductivity | µmho/cm | 716 | - | - | USEPA Method 120.1 |
| 9. | Cyanide CN | mg/L | <0.01 | 0.05 | No Relaxation | APHA 4500 CN-C&F 23rd Edition,2017 |
| 10. | Fluoride as F | mg/L | 0.63 | 1 | 1.5 | CPCB Guide Manual: Water & Waste Water Analysis |
| 11. | Hardness Total (as CaCO3) | mg/L | 140 | 200 | 600 | APHA 2340 C 23rd Edition, 2017 |
| 12. | Nitrogen (Nitrate) NO3 | mg/L | 2014 | 45 | No Relaxation | APHA 4500 NO-3B 23rd Edition,2017 |
| 13. | Total Dissolved Solids | mg/L | 382 | 500 | 2000 | APHA 2540 C 23rd Edition,2017 |
| 14. | Sulphate as SO4 | mg/L | 19.6 | 200 | 400 | APHA 4500-SO2-4E 23rd Edition,2017 |
| 15. | Turbidity | NTU | <1 | 1 | 5 | APHA 3130 B 23rd Edition,2017 |
| 16. | Taste | Qualitative | Agreeable | Agreeable | Agreeable | APHA 2160 B 23rd Edition,2017 |
| 17. | Chromium (Hexavalent) | mg/L | <0.01 | - | - | USEPA Method 7196A |
| 18. | Cadmium | mg/L | <0.001 | 0.003 | No Relaxation | APHA 3125 B 23rd Edition,2017 |
| 19. | Potassium | mg/L | 3.7 | - | - | APHA 3125 B 23rd Edition,2017 |
| 20. | Sodium | mg/L | 12.4 | - | - | APHA 3125 B 23rd Edition,2017 |
| 21. | Copper as Cu | mg/L | <0.001 | 0.05 | 1.5 | APHA 3125 B 23rd Edition,2017 |
| 22. | Iron as Fe | mg/L | 0.09 | 0.3 | No Relaxation | APHA 3125 B 23rd Edition,2017 |
| 23. | Lead as Pb | mg/L | <0.001 | 0.01 | No Relaxation | APHA 3125 B 23rd Edition,2017 |
| 24. | Manganese as Mn | mg/L | <0.01 | 0.1 | 0.3 | APHA 3125 B 23rd Edition,2017 |
| 25. | Zinc as Zn | mg/L | 0.05 | 5 | 15 | APHA 3125 B 23rd Edition,2017 |
| 26. | Selenium | mg/L | <0.001 | 0.01 | No Relaxation | APHA 3125 B 23rd Edition,2017 |
| 27. | Mercury | mg/L | <0.0001 | 0.001 | No Relaxation | APHA 3125 B 23rd Edition,2017 |
| 28. | Magnesium as Mg | mg/L | 13.12 | 30 | 100 | APHA 3125 B 23rd Edition,2017 |
| 29. | Total Arsenic | mg/L | <0.001 | 0.01 | 0.05 | APHA 3125 B 23rd Edition,2017 |

**2.3.4 Discussion on Ground Water Quality at Project Site**

The ground water quality in the project area is observed to having total alkalinity up to 185 mg/L which is within desirable limit of 200 mg/L. Total dissolved solids in the ground water is 382 mg/L which is lower than the prescribed limit of 500 mg/L.

**Table 2.12 Ground Water Quality Monitoring Results at Khubanpur Village**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **S. No** | **Substance or Characteristic** | **Units** | **Result** | **Requirements** | **Methods of Test** |
| **Requirement (Desirable Limit)** | **Permissible Limit in the Absence of Alternate Source** |
| 1. | Colour | Hazen  | <1 | Max. 5 | 15 | APHA 2120 B&C 23rd Edition,2017 |
| 2. | Odour | Qualitative | Agreeable | Agreeable | Agreeable | APHA 2150 B 23rd Edition,2017 |
| 3. | pH value | - | 7.38 | 6.5 to 8.5 | No Relaxation | APHA 4500H+B 23rd Edition,2017 |
| 4. | Alkalinity as HCO3 | mg/L | 190 | 200 | 600 | APHA 2320 B 23rd Edition,2017 |
| 5. | Boron | mg/L | <0.01 | 0.5 | 1.0 | APHA 3125 B 23rd Edition,2017 |
| 6. | Calcium as Ca | mg/L | 38.6 | 75 | 200 | APHA 3500-Ca B 23rd Edition,2017 |
| 7. | Chloride as Cl | mg/L | 25 | 250 | 1000 | APHA 4500 Cl-B 23rd Edition,2017 |
| 8. | Conductivity | µmho/cm | 781 | - | - | USEPA Method 120.1 |
| 9. | Cyanide CN | mg/L | <0.01 | 0.05 | No Relaxation | APHA 4500 CN-C&F 23rd Edition,2017 |
| 10. | Fluoride as F | mg/L | 0.72 | 1 | 1.5 | CPCB Guide Manual: Water & Waste Water Analysis |
| 11. | Hardness Total (as CaCO3) | mg/L | 164 | 200 | 600 | APHA 2340 C 23rd Edition, 2017 |
| 12. | Nitrogen (Nitrate) NO3 | mg/L | 2.27 | 45 | No Relaxation | APHA 4500 NO-3B 23rd Edition,2017 |
| 13. | Total Dissolved Solids | mg/L | 392 | 500 | 2000 | APHA 2540 C 23rd Edition,2017 |
| 14. | Sulphate as SO4 | mg/L | 21.4 | 200 | 400 | APHA 4500-SO2-4E 23rd Edition,2017 |
| 15. | Turbidity | NTU | <1 | 1 | 5 | APHA 3130 B 23rd Edition,2017 |
| 16. | Taste | Qualitative | Agreeable | Agreeable | Agreeable | APHA 2160 B 23rd Edition,2017 |
| 17. | Chromium (Hexavalent) | mg/L | <0.01 | - | - | USEPA Method 7196A |
| 18. | Cadmium | mg/L | <0.001 | 0.003 | No Relaxation | APHA 3125 B 23rd Edition,2017 |
| 19. | Potassium | mg/L | 3.7 | - | - | APHA 3125 B 23rd Edition,2017 |
| 20. | Sodium | mg/L | 11.4 | - | - | APHA 3125 B 23rd Edition,2017 |
| 21. | Copper as Cu | mg/L | <0.001 | 0.05 | 1.5 | APHA 3125 B 23rd Edition,2017 |
| 22. | Iron as Fe | mg/L | 0.07 | 0.3 | No Relaxation | APHA 3125 B 23rd Edition,2017 |
| 23. | Lead as Pb | mg/L | <0.001 | 0.01 | No Relaxation | APHA 3125 B 23rd Edition,2017 |
| 24. | Manganese as Mn | mg/L | <0.01 | 0.1 | 0.3 | APHA 3125 B 23rd Edition,2017 |
| 25. | Zinc as Zn | mg/L | 0.04 | 5 | 15 | APHA 3125 B 23rd Edition,2017 |
| 26. | Selenium | mg/L | <0.001 | 0.01 | No Relaxation | APHA 3125 B 23rd Edition,2017 |
| 27. | Mercury | mg/L | <0.0001 | 0.001 | No Relaxation | APHA 3125 B 23rd Edition,2017 |
| 28. | Magnesium as Mg | mg/L | 16.4 | 30 | 100 | APHA 3125 B 23rd Edition,2017 |
| 29. | Total Arsenic | mg/L | <0.001 | 0.01 | 0.05 | APHA 3125 B 23rd Edition,2017 |

**2.3.5 Discussion on Ground Water Quality at Khubanpur Village**

The ground water quality in the project area is observed to having Total Alkalinity up to 190 mg/L which is within desirable limit of 200 mg/L. Total dissolved solids in the ground water is 392 mg/L which is lower than the prescribed limit of 500 mg/L.

**Table 2.13 Ground Water Quality Monitoring Results at Bhagwanpur Village**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **S. No** | **Substance or Characteristic** | **Units** | **Result** | **Requirements** | **Methods of Test** |
| **Requirement (Desirable Limit)** | **Permissible Limit in the Absence of Alternate Source** |
| 1. | Colour | Hazen  | <1 | Max. 5 | 15 | APHA 2120 B&C 23rd Edition,2017 |
| 2. | Odour | Qualitative | Agreeable | Agreeable | Agreeable | APHA 2150 B 23rd Edition,2017 |
| 3. | pH value | - | 7.45 | 6.5 to 8.5 | No Relaxation | APHA 4500H+B 23rd Edition,2017 |
| 4. | Alkalinity as HCO3 | mg/L | 182 | 200 | 600 | APHA 2320 B 23rd Edition,2017 |
| 5. | Boron | mg/L | <0.01 | 0.5 | 1.0 | APHA 3125 B 23rd Edition,2017 |
| 6. | Calcium as Ca | mg/L | 37.1 | 75 | 200 | APHA 3500-Ca B 23rd Edition,2017 |
| 7. | Chloride as Cl | mg/L | 24 | 250 | 1000 | APHA 4500 Cl-B 23rd Edition,2017 |
| 8. | Conductivity | µmho/cm | 758 | - | - | USEPA Method 120.1 |
| 9. | Cyanide CN | mg/L | <0.01 | 0.05 | No Relaxation | APHA 4500 CN-C&F 23rd Edition,2017 |
| 10. | Fluoride as F | mg/L | 0.65 | 1 | 1.5 | CPCB Guide Manual: Water & Waste Water Analysis |
| 11. | Hardness Total (as CaCO3) | mg/L | 156 | 200 | 600 | APHA 2340 C 23rd Edition, 2017 |
| 12. | Nitrogen (Nitrate) NO3 | mg/L | 3.46 | 45 | No Relaxation | APHA 4500 NO-3B 23rd Edition,2017 |
| 13. | Total Dissolved Solids | mg/L | 391 | 500 | 2000 | APHA 2540 C 23rd Edition,2017 |
| 14. | Sulphate as SO4 | mg/L | 20.72 | 200 | 400 | APHA 4500-SO2-4E 23rd Edition,2017 |
| 15. | Turbidity | NTU | <1 | 1 | 5 | APHA 3130 B 23rd Edition,2017 |
| 16. | Taste | Qualitative | Agreeable | Agreeable | Agreeable | APHA 2160 B 23rd Edition,2017 |
| 17. | Chromium (Hexavalent) | mg/L | <0.01 | - | - | USEPA Method 7196A |
| 18. | Cadmium | mg/L | <0.001 | 0.003 | No Relaxation | APHA 3125 B 23rd Edition,2017 |
| 19. | Potassium | mg/L | 3.8 | - | - | APHA 3125 B 23rd Edition,2017 |
| 20. | Sodium | mg/L | 10.4 | - | - | APHA 3125 B 23rd Edition,2017 |
| 21. | Copper as Cu | mg/L | <0.001 | 0.05 | 1.5 | APHA 3125 B 23rd Edition,2017 |
| 22. | Iron as Fe | mg/L | 0.08 | 0.3 | No Relaxation | APHA 3125 B 23rd Edition,2017 |
| 23. | Lead as Pb | mg/L | <0.001 | 0.01 | No Relaxation | APHA 3125 B 23rd Edition,2017 |
| 24. | Manganese as Mn | mg/L | <0.01 | 0.1 | 0.3 | APHA 3125 B 23rd Edition,2017 |
| 25. | Zinc as Zn | mg/L | 0.03 | 5 | 15 | APHA 3125 B 23rd Edition,2017 |
| 26. | Selenium | mg/L | <0.001 | 0.01 | No Relaxation | APHA 3125 B 23rd Edition,2017 |
| 27. | Mercury | mg/L | <0.0001 | 0.001 | No Relaxation | APHA 3125 B 23rd Edition,2017 |
| 28. | Magnesium as Mg | mg/L | 15.37 | 30 | 100 | APHA 3125 B 23rd Edition,2017 |
| 29. | Total Arsenic | mg/L | <0.001 | 0.01 | 0.05 | APHA 3125 B 23rd Edition,2017 |

**2.3.6 Discussion on Ground Water Quality at Bhagwanpur Village**

The ground water quality in the project area is observed to having Total Alkalinity up to 182 mg/L which is within desirable limit of 200 mg/L. Total dissolved solids in the ground water is 391 mg/L which is lower than the prescribed limit of 500 mg/L.

**Table 2.14 Ground Water Quality Monitoring Results of Industrial area Bhagwanpur**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **S. No** | **Substance or Characteristic** | **Units** | **Result** | **Requirements** | **Methods of Test** |
| **Requirement (Desirable Limit)** | **Permissible Limit in the Absence of Alternate Source** |
| 1. | Colour | Hazen  | <1 | Max. 5 | 15 | APHA 2120 B&C 23rd Edition,2017 |
| 2. | Odour | Qualitative | Agreeable | Agreeable | Agreeable | APHA 2150 B 23rd Edition,2017 |
| 3. | pH value | - | 7.53 | 6.5 to 8.5 | No Relaxation | APHA 4500H+B 23rd Edition,2017 |
| 4. | Alkalinity as HCO3 | mg/L | 188 | 200 | 600 | APHA 2320 B 23rd Edition,2017 |
| 5. | Boron | mg/L | <0.01 | 0.5 | 1.0 | APHA 3125 B 23rd Edition,2017 |
| 6. | Calcium as Ca | mg/L | 39.2 | 75 | 200 | APHA 3500-Ca B 23rd Edition,2017 |
| 7. | Chloride as Cl | mg/L | 28 | 250 | 1000 | APHA 4500 Cl-B 23rd Edition,2017 |
| 8. | Conductivity | µmho/cm | 731 | - | - | USEPA Method 120.1 |
| 9. | Cyanide CN | mg/L | <0.01 | 0.05 | No Relaxation | APHA 4500 CN-C&F 23rd Edition,2017 |
| 10. | Fluoride as F | mg/L | 0.59 | 1 | 1.5 | CPCB Guide Manual: Water & Waste Water Analysis |
| 11. | Hardness Total (as CaCO3) | mg/L | 158 | 200 | 600 | APHA 2340 C 23rd Edition, 2017 |
| 12. | Nitrogen (Nitrate) NO3 | mg/L | 2.96 | 45 | No Relaxation | APHA 4500 NO-3B 23rd Edition,2017 |
| 13. | Total Dissolved Solids | mg/L | 377 | 500 | 2000 | APHA 2540 C 23rd Edition,2017 |
| 14. | Sulphate as SO4 | mg/L | 22.4 | 200 | 400 | APHA 4500-SO2-4E 23rd Edition,2017 |
| 15. | Turbidity | NTU | <1 | 1 | 5 | APHA 3130 B 23rd Edition,2017 |
| 16. | Taste | Qualitative | Agreeable | Agreeable | Agreeable | APHA 2160 B 23rd Edition,2017 |
| 17. | Chromium (Hexavalent) | mg/L | <0.01 | - | - | USEPA Method 7196A |
| 18. | Cadmium | mg/L | <0.001 | 0.003 | No Relaxation | APHA 3125 B 23rd Edition,2017 |
| 19. | Potassium | mg/L | 3.4 | - | - | APHA 3125 B 23rd Edition,2017 |
| 20. | Sodium | mg/L | 9.8 | - | - | APHA 3125 B 23rd Edition,2017 |
| 21. | Copper as Cu | mg/L | <0.001 | 0.05 | 1.5 | APHA 3125 B 23rd Edition,2017 |
| 22. | Iron as Fe | mg/L | 0.07 | 0.3 | No Relaxation | APHA 3125 B 23rd Edition,2017 |
| 23. | Lead as Pb | mg/L | <0.001 | 0.01 | No Relaxation | APHA 3125 B 23rd Edition,2017 |
| 24. | Manganese as Mn | mg/L | <0.01 | 0.1 | 0.3 | APHA 3125 B 23rd Edition,2017 |
| 25. | Zinc as Zn | mg/L | 0.05 | 5 | 15 | APHA 3125 B 23rd Edition,2017 |
| 26. | Selenium | mg/L | <0.001 | 0.01 | No Relaxation | APHA 3125 B 23rd Edition,2017 |
| 27. | Mercury | mg/L | <0.0001 | 0.001 | No Relaxation | APHA 3125 B 23rd Edition,2017 |
| 28. | Magnesium as Mg | mg/L | 14.58 | 30 | 100 | APHA 3125 B 23rd Edition,2017 |
| 29. | Total Arsenic | mg/L | <0.001 | 0.01 | 0.05 | APHA 3125 B 23rd Edition,2017 |

**2.3.7 Discussion on Ground Water Quality of at Industrial Area Bhagwanpur**

The ground water quality in the project area is observed to having total alkalinity up to 188 mg/L which is within desirable limit of 200 mg/L. Total dissolved solids in the ground water is 377 mg/L which is lower than the prescribed limit of 500 mg/L.

**Table 2.15 Ground Water Quality Monitoring Results Near Main Gate**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **S. No** | **Substance or Characteristic** | **Units** | **Result** | **Requirements** | **Methods of Test** |
| **Requirement (Desirable Limit)** | **Permissible Limit in the Absence of Alternate Source** |
| 1. | Colour | Hazen  | <1 | Max. 5 | 15 | APHA 2120 B&C 23rd Edition,2017 |
| 2. | Odour | Qualitative | Agreeable | Agreeable | Agreeable | APHA 2150 B 23rd Edition,2017 |
| 3. | pH value | - | 7.48 | 6.5 to 8.5 | No Relaxation | APHA 4500H+B 23rd Edition,2017 |
| 4. | Alkalinity as HCO3 | mg/L | 195 | 200 | 600 | APHA 2320 B 23rd Edition,2017 |
| 5. | Boron | mg/L | <0.01 | 0.5 | 1.0 | APHA 3125 B 23rd Edition,2017 |
| 6. | Calcium as Ca | mg/L | 37.5 | 75 | 200 | APHA 3500-Ca B 23rd Edition,2017 |
| 7. | Chloride as Cl | mg/L | 25 | 250 | 1000 | APHA 4500 Cl-B 23rd Edition,2017 |
| 8. | Conductivity | µmho/cm | 719 | - | - | USEPA Method 120.1 |
| 9. | Cyanide CN | mg/L | <0.01 | 0.05 | No Relaxation | APHA 4500 CN-C&F 23rd Edition,2017 |
| 10. | Fluoride as F | mg/L | 0.66 | 1 | 1.5 | CPCB Guide Manual: Water & Waste Water Analysis |
| 11. | Hardness Total (as CaCO3) | mg/L | 168 | 200 | 600 | APHA 2340 C 23rd Edition, 2017 |
| 12. | Nitrogen (Nitrate) NO3 | mg/L | 2.76 | 45 | No Relaxation | APHA 4500 NO-3B 23rd Edition,2017 |
| 13. | Total Dissolved Solids | mg/L | 403 | 500 | 2000 | APHA 2540 C 23rd Edition,2017 |
| 14. | Sulphate as SO4 | mg/L | 22.6 | 200 | 400 | APHA 4500-SO2-4E 23rd Edition,2017 |
| 15. | Turbidity | NTU | <1 | 1 | 5 | APHA 3130 B 23rd Edition,2017 |
| 16. | Taste | Qualitative | Agreeable | Agreeable | Agreeable | APHA 2160 B 23rd Edition,2017 |
| 17. | Chromium (Hexavalent) | mg/L | <0.01 | - | - | USEPA Method 7196A |
| 18. | Cadmium | mg/L | <0.001 | 0.003 | No Relaxation | APHA 3125 B 23rd Edition,2017 |
| 19. | Potassium | mg/L | 3.8 | - | - | APHA 3125 B 23rd Edition,2017 |
| 20. | Sodium | mg/L | 11.7 | - | - | APHA 3125 B 23rd Edition,2017 |
| 21. | Copper as Cu | mg/L | <0.001 | 0.05 | 1.5 | APHA 3125 B 23rd Edition,2017 |
| 22. | Iron as Fe | mg/L | 0.06 | 0.3 | No Relaxation | APHA 3125 B 23rd Edition,2017 |
| 23. | Lead as Pb | mg/L | <0.001 | 0.01 | No Relaxation | APHA 3125 B 23rd Edition,2017 |
| 24. | Manganese as Mn | mg/L | <0.01 | 0.1 | 0.3 | APHA 3125 B 23rd Edition,2017 |
| 25. | Zinc as Zn | mg/L | 0.02 | 5 | 15 | APHA 3125 B 23rd Edition,2017 |
| 26. | Selenium | mg/L | <0.001 | 0.01 | No Relaxation | APHA 3125 B 23rd Edition,2017 |
| 27. | Mercury | mg/L | <0.0001 | 0.001 | No Relaxation | APHA 3125 B 23rd Edition,2017 |
| 28. | Magnesium as Mg | mg/L | 18.04 | 30 | 100 | APHA 3125 B 23rd Edition,2017 |
| 29. | Total Arsenic | mg/L | <0.001 | 0.01 | 0.05 | APHA 3125 B 23rd Edition,2017 |

**2.3.8 Discussion on Ground Water Quality near Main Gate**

The ground water quality in the project area is observed to having total alkalinity up to 195 mg/L which is within desirable limit of 200 mg/L. Total dissolved solids in the ground water is 403 mg/L which is lower than the prescribed limit of 500 mg/L.

**2.3.9 Waste Water Quality Monitoring**

**2.3.9.1 Waste Water Quality Monitoring Locations**

**Table 2.16 Details of Waste Water Quality Monitoring Station**

|  |  |  |
| --- | --- | --- |
| **S. No.** | * + - * 1. **Location Code**
 | **Location Name/ Description** |
| 1. | ETP | Inlet |
| 2. | ETP | Outlet |

**2.3.9.2 Waste Water Quality Monitoring Results**

The detailed Waste water quality monitoring results are presented in **Table 2.17**

**Table 2.17 Waste Water Quality Monitoring Results**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **S. No** | **Parameters** | **Units** | **ETP (Inlet)** | **ETP (Outlet)** | **ETP Outlet Requirement**  | **Methods of Test** |
| 1. | Total Suspended Solids | mg/l | 503 | 297 | Max.600 | APHA2540 D23rd Edition 2017 |
| 2. | pH | - | 8.13 | 7.71 | 5.5-9.0 | APHA4500-H+B23rd Edition 2017 |
| 3. | Total Dissolved Solids | mg/l | 7118 | 1692 | - | APHA2540 C23rd Edition 2017 |
| 4. | Oil & Grease | mg/l | 21.8 | 8.7 | Max. 20 | EPA Method 1664 |
| 5. | Nitrogen (Free Ammonia as NH3/as N) | mg/l | 57.6 | 29.4 | Max. 50 | CPCB Guide Manual: Water & waste water Analysis |
| 6. | BOD, 3 Days @ 27°C | mg/l | 566 | 182 | Max. 350 | CPCB Guide Manual: Water & waste water Analysis |
| 7. | COD | mg/l | 2712 | 864 | - | CPCB Guide Manual: Water & waste water Analysis |

**2.3.9.3 Discussion on ETP water Quality**

The outlet water quality of ETP was found to be within prescribed limits.

**2.4 Soil Quality Monitoring**

**2.4.1 Soil Quality Monitoring Location**

The objectives of the soil monitoring are to identify the impacts of ongoing project activities on soil quality and also predict impacts, which have arisen due to execution of various activities. Accordingly, a study of assessment of the soil quality has been carried out.

To assess impacts of ongoing project activities on the soil in the area, the physico-chemical characteristics of soils were examined by obtaining soil samples from selected points and analysis of the same. Since sample of soil was collected from the Project site and Nearby Area for studying soil characteristics, the location of which is listed in **Table 2.18.**

**Table 2.18 Details of Soil Monitoring Location**

|  |  |  |
| --- | --- | --- |
| **S.No** | **Location Code** | **Location Name/Description** |
| 1. | S1 | Project Site |
| 2. | S2 | Khubanpur Village |
| 3. | S3 | Bhagwanpur Village |
| 4. | S4 | Industrial Area Bhagwanpur |
| 5. | S5 | Near Main Gate  |

**2.4.2 Methodology of Soil Quality Monitoring**

The sampling has been done in line with IS: 2720 & Methods of Soil Analysis, Part-1, 2nd edition, 1986 of American Society for Agronomy and Soil Science Society of America. The homogenized samples were analyzed for physical and chemical characteristics (physical, chemical and heavy metal concentrations). The soil samples were collected in the month of March 2019.

The samples have been analyzed as per the established scientific methods for Physico-chemical parameters. The result of soil sampling is compiled in **Table 2.19.**

**2.4.3 Soil Quality Monitoring Results**

**Table 2.19 Soil Quality Monitoring Results**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S.No** | **Parameters** | **Test Results** | **Unit** | **Test Method** |
| **S1** | **S2** | **S3** | **S4** | **S5** |
| 1. | pH (at 25 °C) | 7.98 | 8.10 | 7.86 | 7.93 | 7.69 | - | USEPA 1998, 9045D |
| 2. | Electrical Conductivity | 135 | 147 | 183 | 141 | 155 | µmhos/cm | USDA |
| 3. | Water Holding Capacity | 15.3 | 14.9 | 15.7 | 15.4 | 14.8 | %  | ASTM D2980-02 |
| 4. | Organic Matter | 0.86 | 0.78 | 0.68 | 0.71 | 0.65 | %  | APHA2540 G23rd Edition, 2017 |
| 5. | Phosphorus | 29 | 25 | 24.5 | 26.2 | 26.7 | mg/kg | USDA |
| 6. | Nitrogen | 127 | 132 | 130 | 138 | 141 | mg/kg | USDA |
| 7. | Total Potassium | 11.4 | 10.6 | 9.6 | 11.3 | 10.9 | mg/kg | USEPA 1640 |
| 8. | Soil Texture | Sandy | Sandy | Sandy | Sandy | Sandy | - | USDA  |
| 9. | Color | Brown | Brown | Brown | Brown | Brown | - | USDA |
| 10. | Porosity | 0.63 | 0.64 | 0.63 | 0.64 | 0.63 | VF (Void Fraction) | USDA |

**2.4.4 Discussion on Soil Quality**

The soil in the study areas is characterised by moderate organic content. The soil quality in the project area has not been affected by the project activities.