# PROJECT REPORT

# ON

# Evaluation of the performance of Sewage Treatment Plant (STP) at Elysium Flushing Meadows

Project Report Submitted to:
Elysium Properties India (P) Ltd - Flushing Meadows,
699, Avinashi Road, Coimbatore – 641 037,
Tamilnadu, India.

This is to certify that pages 1 to 36 (cover to end) of the report is prepared based on the findings of the sample analysis and measurements carried out at Elysium Flushing Meadows.

10/Dec/2021

डॉ. एस. माधव कुमार
Dr. S. MATHAVA KUMAR
सह प्राध्यापक / Associate Professor
सिविल इंजीनियरिंग / Civil Engineering
आई.आई.टी. मद्रास / I.I.T. Madras
चेन्नै / Chennai-600 036.


**Prepared by**

**Dr. S. Mathava Kumar**

**Associate Professor,**

**Environmental & Water Resources Engg.**

**Department of Civil Engineering**

**Indian Institute of Technology Madras**

**Chennai - 600036, India**

## TABLE OF CONTENTS

## LIST OF FIGURES

## LIST OF TABLES

# CHAPTER 1

# INTRODUCTION

### 1.1 Location

Elysium Flushing Meadows (EFM) is located in Vellanaipatti village that comes under Annur taluk, Coimbatore district. It is located at a distance of 5.5 to 6 km from the Coimbatore international airport. It spreads over a sprawling area of 15 Acres. There are in total 126 individual villas out of which 100 villas are occupied with an average of 4 persons per household. The project was launched in 2012 and it was completed in the year 2014. Fig. 1 shows the location of the study area.

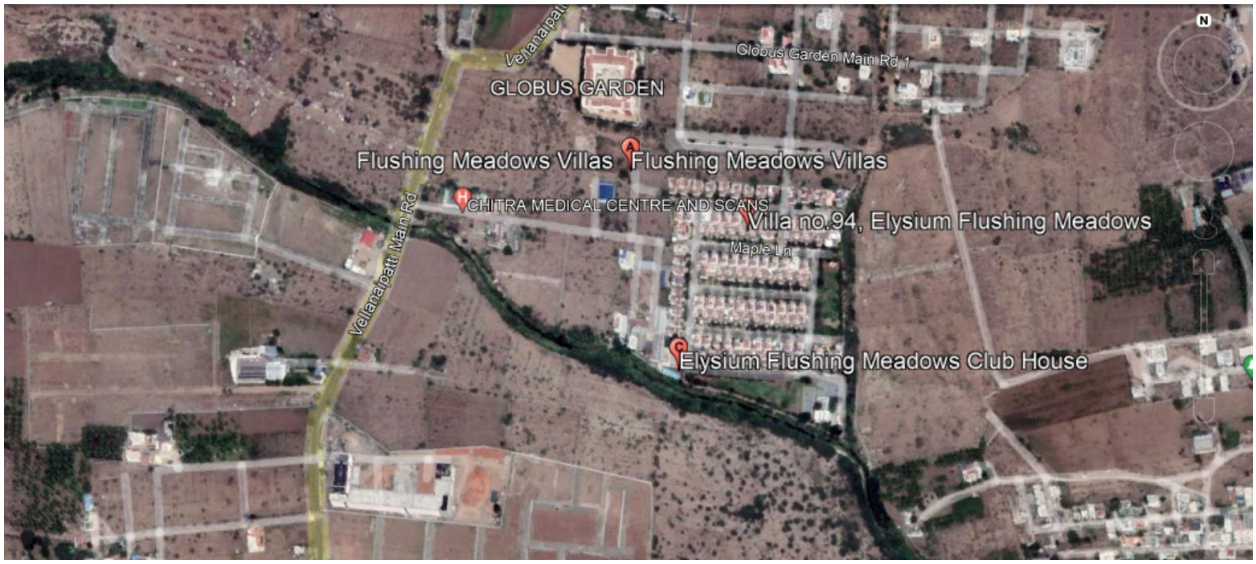



**Figure 1.** Location map of Elysium Flushing Meadows Clubhouse

### 1.2 Study area

The sewage treatment plant (STP) is located inside the EFM at latitude of 12.847° and longitude of 79.700° as shown in Fig. 1. Operations of STP commenced from the year 2015 after obtaining consent to operate from Tamil Nadu Pollution Control Board (TNPCB). STP in EFM is an underground structure covered by asbestos cement (AC) sheets on the top as shown in Fig. 2. Adjacent places of STP includes two villas and a playground that are located at a distance of about 100 m from it. Apart from the places mentioned, there is a stream which is running just behind the boundary of EFM. The wastewater reaching the STP is collected through underdrains from all the villas in EFM. The effluent coming out after treatment is used for the purpose of gardening. The operation and maintenance of the plant was given to M/s Eco Green Technologies, Coimbatore from 30$^{th}$ April 2019. The agreement signed between the EFM and M/s Eco Green Technologies is attached in Annexure I.


**Figure 2.** View of the STP interior in EFM.

### 1.3 Standards for treated STP effluent for discharge / Land application

TNPCB has prescribed the standards (Source: National Green Tribunal order dated 30.4.2019 in Original Application number 1069/2018) for the STPs for all modes of disposal for different class of cities. The guidelines also suggest to reuse or recycle the treated wastewater to a maximum extent. The standards were given based on the population of the considered region. The standards are provided for pH, biochemical oxygen demand (BOD), chemical oxygen demand (COD), total suspended solids (TSS), total nitrogen (TN), total phosphorus (TP) and fecal coliforms (FC). The prescribed standards are provided in Table 1. In the past, treated STP effluent samples were collected by TNPCB from STP in EFM. Compliance of EFM STP samples done by TNPCB is attached in Annexure II.

**Table 1.** Standards prescribed by TNPCB for effluent disposal

| Parameters | Standards (Applicable to all mode of disposal) | | | |
|---|---|---|---|---|
| | **Mega and Metropolitan Cities** | **Class I Cities** | **Others** | **Deep Marine Outfall** |
| **pH** | 5.5 - 9.0 | 5.5 - 9.0 | 5.5 - 9.0 | 5.5 - 9.0 |
| **BOD** | 10 | 20 | 30 | 30 |
| **TSS** | 20 | 30 | 50 | 50 |
| **COD** | 50 | 100 | 150 | 150 |
| **TN** | 10 | 15 | - | - |
| **TP** | 1.0 | 1.0 | 1.0 | - |
| **FC** | Desirable- 100<br>Permissible- 230 | Desirable- 230<br>Permissible- 1000 | Desirable- 1000<br>Permissible- 10,000 | Desirable- 1000<br>Permissible- 10,000 |

*Note:*

(i). Mega-Metropolitan Cities have population more than 1 crore, Metropolitan Cities- Population more than 10 Lakhs and Class-1 Population more than 1 Lakh.

(ii). All values are in mg/l except pH and Fecal Coliform (in MPN/100mL).

(iii). The study is classified under others category according to TNPCBs norms.

Central Public Health and Environmental Engineering Organization (CPHEEO) provides the guidelines for operation and maintenance of the STP. It has also prescribed standards for the reuse of treated effluent depending upon the purpose for which it is to be used. The standards were prescribed for toilet flushing, fire protection, vehicle exterior washing, non-contact impoundments, landscaping, horticulture and agriculture. Landscaping, horticulture and agriculture section is further sub-divided into edible and non-edible crops respectively. Since EFM uses the treated water for gardening purpose and has agreed to use part of its treated water for flushing, standards pertaining to non-edible crops and toilet flushing given by CPHEEO are presented in Table 2.

**Table 2.** Reuse standards prescribed by CPHEEO for non-edible crops and toilet flushing

| Parameter | Non-edible gardening standards | Flushing Standards |
|---|---|---|
| **Temperature** | Ambient | Ambient |
| **Color** | AA | Colorless |
| **Suspended solids** | 30 | Nil |
| **TDS** | 2100 | 2100 |
| **pH** | 6.5-8.3 | 6.5-8.3 |
| **BOD** | 20 | 10 |
| **COD** | 30 | 30 |
| **Minimum residual chlorine** | 1 | 1 |
| **Nitrate nitrogen as N** | 10 | 10 |
| **Dissolved phosphorous as P** | 1 | 5 |
| **FC** | 230 | Nil |

*Note*:

(i). All units are in mg/L except pH, Temperature ($^{O}$C) and FC (MPN/100 mL).

(ii). AA- as arising when other parameters are satisfied.

(iii). A tolerance of 5% is allowable when yearly average values are considered.

# CHAPTER 2

# SEWAGE TREATMENT PLANT

## 2.1 Sewage treatment plant

The STP has been designed to treat 125 KLD of sewage. The treatment system is designed to reduce pollutants such as BOD, COD, TSS etc. The proposed scheme of treatment (Fig. 2) in the STP consist of perforated screen, collection tank (flow equalization), aeration tank (secondary biological treatment based on conventional activated sludge process with sludge recirculation). Moreover, the STP was given with a provision of sludge drying beds, pressure sand filter (PSF), activated carbon filter (ACF) and disinfection units. The dimensions of various units of the STP are provided in Table 2.

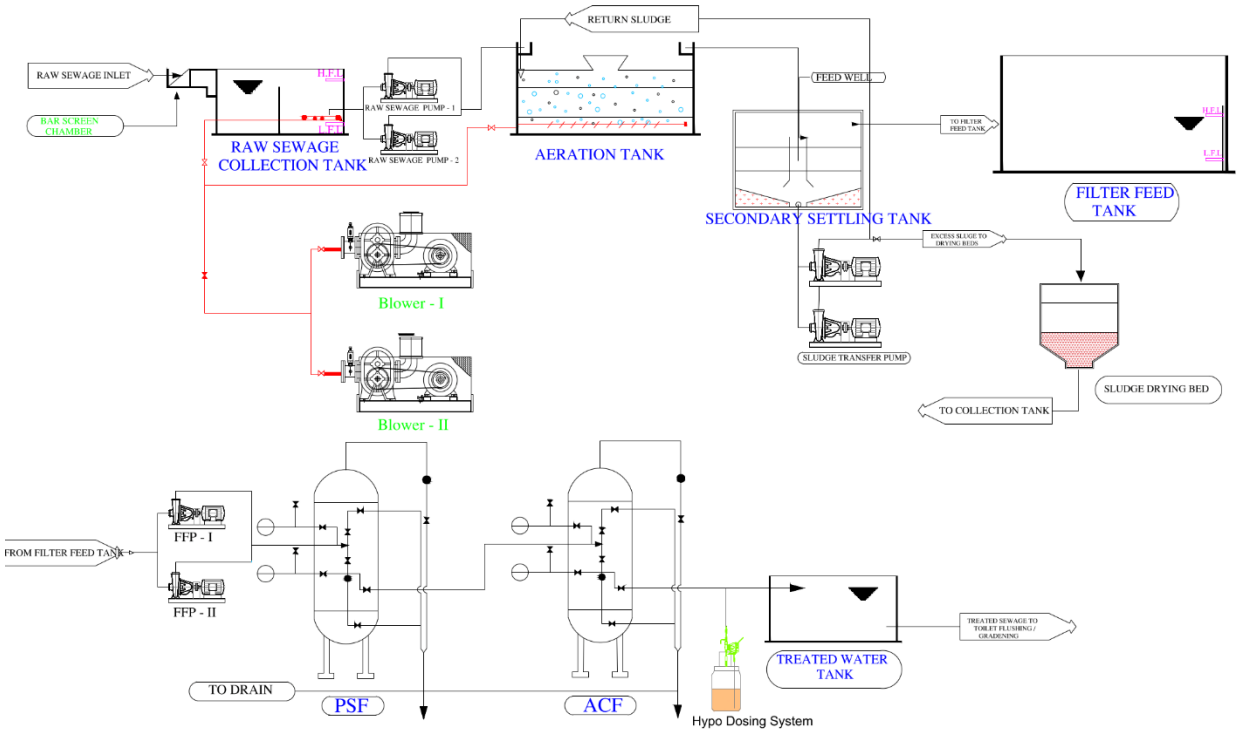



**Figure 3.** Proposed treatment scheme of the STP at EFM.

The wastewater generated in the villas is collected through underdrains that reach the screening unit. A single perforated screen was separating the floating substances from the raw sewage. Subsequently, this wastewater is directed to flow into a collection sump by gravity. The screened sewage in the collection tank is pumped into the aeration tank by two submersible pumps that has a capacity of 3HP each and operates at a flow rate of 5.5 L/s. The pumped sewage enters the aeration tank provided with surface aeration. The blower capacity used for aeration is around 200 $m^3/h$ at a pressure of about 0.5 bar. The water from the aeration tank enters the secondary clarifier where the solid-liquid separation occurs. The clarified water enters the tertiary treatment unit

consisting of PSF and ASF. On the other hand, the biomass from the secondary clarifier is recirculated back to the aeration tank (recirculation ratio = 2) with the help of recirculation pumps with a capacity of 1 HP and at a flow rate of 2.9 L/s (2 nos.).

**Table 3.** Dimensions of the treatment units in STP

| Sl. No. | Description | Type | Length (m) | Breadth (m) | Height (m) | Volume ($m^3$) |
|---|---|---|---|---|---|---|
| 1 | Collection Tank | Rectangular Basin | 11.5 | 3.5 | 3.5 | 140.9 |
| 2 | Aeration Tank | Rectangular Basin | 7.8 | 4 | 4.5 | 140.4 |
| 3 | Filter Feed Tank | Rectangular Basin | 5.5 | 3 | 2.5 | 41.25 |
| 4 | Treated Water Tank | Rectangular Basin | 4 | 2.5 | 2.5 | 25 |
| | | | Diameter (m) | | Height (m) | Volume ($m^3$) |
| 5 | Filters (PSF &ACF) | Cylindrical Basin | 0.9 | | 1.8 | 1.15 |
| 6 | Secondary Clarifier | Cylindrical Basin | 3.5 | | 3 | 28 |

Clarified water from the secondary clarifier enters the filter feed tank from which the water is pumped to the PSF and ACF, respectively. There are two filter feed pumps, namely, FFP1 and FFP 2 pumping filter feed outlet to PSF and ACF, respectively. The outlet water from ACF is dosed with a proprietary disinfectant after it enters the effluent holding tank to ensure proper disinfection. The water from the effluent holding tank is reused for gardening inside EFM clubhouse. The color of inlet wastewater was dark-grey and observed to have a foul odor.

### 2.2 Sample collection

A preliminary site investigation was carried out for fixing the sampling points. Based on the preliminary investigation, 8 sampling points were chosen. Sampling was performed on 28-8-2021. The sampling points are shown in Fig. 4. The samples were collected in 1 L plastic sampling containers. Samples from collection tank, aeration tank and effluent were taken in BOD bottles for BOD determination (Fig. 5a). Apart from sample collection the amount of settleable solids in the aeration tank is also measured by taking a well-mixed sample from the aeration tank (Fig. 5b).


**Figure 4.** Diagram of the showing the sampling points in the STP of EFM

As soon as the samples were collected, the containers were labelled and transferred to an insulated ice box as shown in Fig. 5c. The ice box was transported to the laboratory in Indian Institute of Technology Madras and the sample containers were stored at 4 °C. Parameters like BOD, COD, MPN were analyzed immediately. Alongside wastewater sample collection, noise monitoring was also carried out at selective places near the STP.

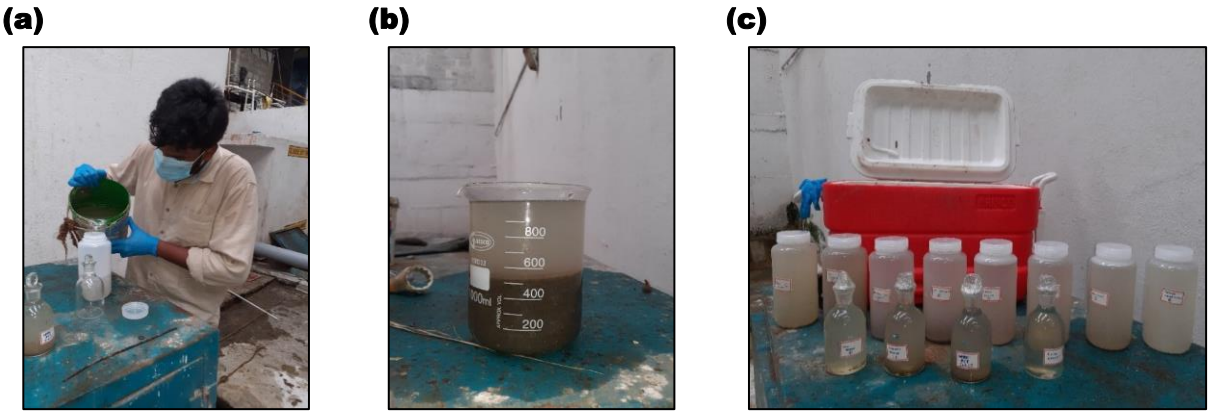



**Figure 5.** Photographs showing (a) Sample collection (b) Settleable solids in aeration tank and (c) Samples collected from STP.

A second sampling was carried out on 22-9-2021 to cross examine the reliability of results obtained during the first sampling. In the second sampling, samples were collected from screening, collection tank, aeration tank and treated effluent tank.

### 2.3 Characterization of wastewater

The collected samples were analyzed as per APHA standard methods. Table 3 shows the list of parameters analyzed along with the methods adopted for carrying out the analysis.

**Table 4.** List of parameters with their method of analysis

| Sl. No | Parameter | Code | Methods |
|---|---|---|---|
| 1 | Colour | Part 2120 | Physical |
| 2 | Odour | Part 2150 | Physical |
| 3 | pH | Part 4500- $H^+$ | pH meter |
| 4 | Electrical Conductivity (EC) | Part 2510 B | Conductivity meter |
| 5 | Dissolved oxygen (DO) | | DO meter |
| 6 | Turbidity | Part 2130 B | Turbidity meter |
| 7 | Biochemical oxygen demand ($BOD_3$) | Part 5210 | Winkler's method |
| 8 | Chemical oxygen demand (COD) | Part 2520 | Closed reflux |
| 9 | Total solids (TS) | Part 2540 B | Gravimetric |
| 10 | Total suspended solids (TSS) | Part 2540 D | Gravimetric |
| 11 | Total dissolved solids (TDS) | Part 2540 C | Gravimetric |
| 12 | Fixed suspended solids (FSS) | Part 2540 E | Gravimetric |
| 13 | Fixed dissolved solids (FDS) | Part 2540 E | Gravimetric |
| 14 | Total Fixed solids (TFS) | Part 2540 E | Gravimetric |
| 15 | Volatile suspended solids (VSS) | Part 2540 E | Gravimetric |
| 16 | Volatile dissolved solids (VDS) | Part 2540 E | Gravimetric |
| 17 | Total volatile solids (TVS) | Part 2540 E | Gravimetric |
| 18 | Sulphates | Part 4500-$SO_4^-$ | Spectrophotometric |
| 19 | Nitrates | Part 4500-$NO_3^-$ | Spectrophotometric |
| 20 | Phosphates | Part 4500-$PO_4^{3-}$ | Stannous chloride |
| 21 | Chlorides | Part 4500-$Cl^-$ | Argentometric Titrimetric |
| 22 | Sodium as $Na^+$ | Part 3500-$Na^+$ | Ion chromatography |
| 23 | Ammonia as $NH_3$ | Part 4500-$NH_4^+$ | Ion Chromatography |
| 24 | Total Coliforms (TC) | Part 9221 B | Multiple tube fermentation |
| 25 | Fecal Coliforms (FC) | Part 9221 B | |

# CHAPTER 3

# RESULTS AND DISCUSSION

### 3.1 Wastewater characteristics

The characteristics of wastewater samples collected at different treatment units of the STP in EFM is presented in Table 5. The results of the second sampling are attached in Annexure III.

**Table 5.** Characteristics of sewage collected from different treatment units during Sampling 1.

| Sl. No | Parameter | S 1 | S 2 | S 3 | S 4 | S 5 | S 6 | S 7 | S 8 |
|---|---|---|---|---|---|---|---|---|---|
| **1** | **pH** | 7.12 | 7.32 | 7.41 | 7.35 | 7.45 | 7.43 | 7.43 | 7.62 |
| **2** | **EC** | 446 | 718 | 735 | 776 | 775 | 778 | 758 | 827 |
| **3** | **Turbidity** | 53.6 | 262 | 267 | 266 | 44 | 42.4 | 49.6 | 21.9 |
| **4** | **TS** | 612 | 1068 | 1052 | 1008 | 748 | 732 | 764 | 740 |
| **5** | **TSS** | 296 | 349 | 348 | 192 | 68 | 68 | 90 | 40 |
| **6** | **TDS** | 316 | 600 | 604 | 648 | 584 | 536 | 556 | 600 |
| **7** | **COD** | 339 | 531 | 326.4 | 275.2 | 93.3 | 90 | 82 | 57.6 |
| **8** | **BOD** | 150 | 200 | 118 | 227.5 | 73.6 | 70.4 | 41.6 | 30 |
| **9** | **DO** | 0.82 | 0.14 | 0.91 | - | - | - | - | 4.02 |
| **10** | **TN** | 29.5 | 48.0 | 51.6 | 49 | 52.7 | 51.0 | 51.8 | 52.1 |
| **11** | **Nitrates** | 1.1 | 0.6 | 2.5 | 2.6 | 2.7 | 3.8 | 2.2 | 1.9 |
| **12** | **Ammonium** | 12.5 | 14 | 14.2 | 14.3 | 14.5 | 14.2 | 14.5 | 11.9 |
| **13** | **Phosphates** | 3.6 | 11.6 | 11.4 | 11.0 | 31.5 | 31.8 | 33.1 | 40.8 |
| **14** | **Chlorides** | 95.6 | 109.9 | 119.6 | 115.0 | 103.1 | 109.9 | 115.3 | 143.6 |
| **15** | **Sulphates** | 12.7 | 52.2 | 51.1 | 46.6 | 38.6 | 41.5 | 43.9 | 46.0 |
| **16** | **Sodium** | 49 | 50.2 | 40.9 | 44.3 | 42.6 | 44.7 | 45.9 | 41.3 |
| **17** | **Potassium** | 7.2 | 6.9 | 6.3 | 7 | 6.4 | 5.9 | 6.4 | 5.9 |
| **18** | **Calcium** | 4.1 | 4.3 | 3.5 | 3.5 | 4.6 | 4.6 | 3.6 | 4.5 |
| **19** | **Magnesium** | 7.4 | 6.1 | 5.9 | 6.4 | 6.5 | 5.9 | 6.3 | 5.4 |
| **20** | **Residual Chlorine** | | BDL | | | | BDL | BDL | BDL |
| **21** | **TC** | | >1600 | | | | | | >1600 |
| **22** | **FC** | | >1600 | | | | | | >1600 |

* BDL- Below Detection Limit

* All values are in mg/L except pH, EC (µS/cm), Turbidity (NTU), FC and TC (MPN/100 mL)

### 3.2 Physical parameters

The sample was grey in color as visible from naked eye and odor was found to be offensive in the samples (S1 to S5). From Table 5, it can be observed that the parameters of S1 are comparatively lesser than that of S2. The reason might be that, the aeration provided in the collection tank prevents the settling of suspended solids. The suspended solids might have contributed to the increase in the parameters of S2.

The pH was observed to be neutral varying from 7.1 to 7.6 in the treatment systems. The pH increased slightly (from 7.3 to 7.4) during biological treatment (Fig. 6). The conductivity was almost stable throughout the treatment units except for S8. The increase might be due to leaching of ions from the exhausted filter bed or due to chlorination. However, analysis of residual chlorine did not show any detectable free chlorine in the system after treatment (Table 5). Also, the increase in pH after S7 shows that chlorination has not been done effectively.

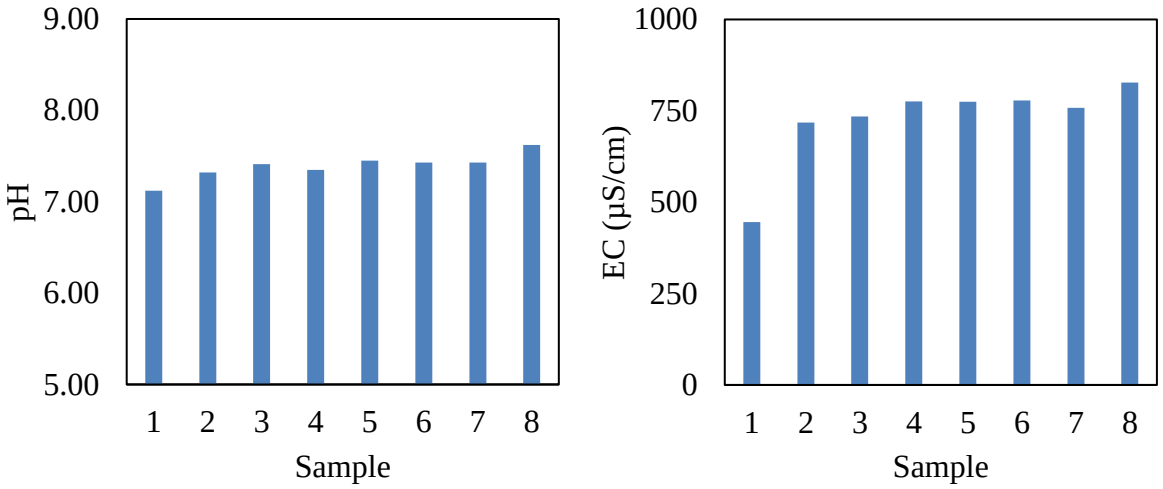



**Figure 6.** Variation of pH and EC in the collected samples

The turbidity and TSS profiles are shown in Fig. 7. It can be observed that TSS and Turbidity have a similar profile. The TSS in the collection tank, aeration outlet and SST outlet are higher compared to other samples. It can be seen that the filtration holding tank (S4) was able to remove some suspended solids. This might be due to the settling of solids in the detention time provided. Turbidity and TSS were removed effectively in the pressure sand filter (S5).

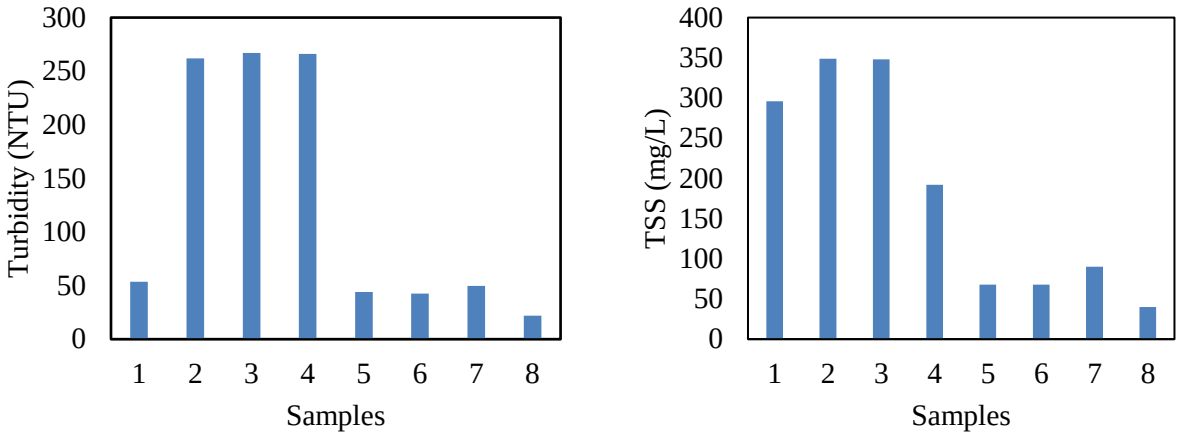



**Figure 7.** Variation of Turbidity and Total suspended solids in the collected samples

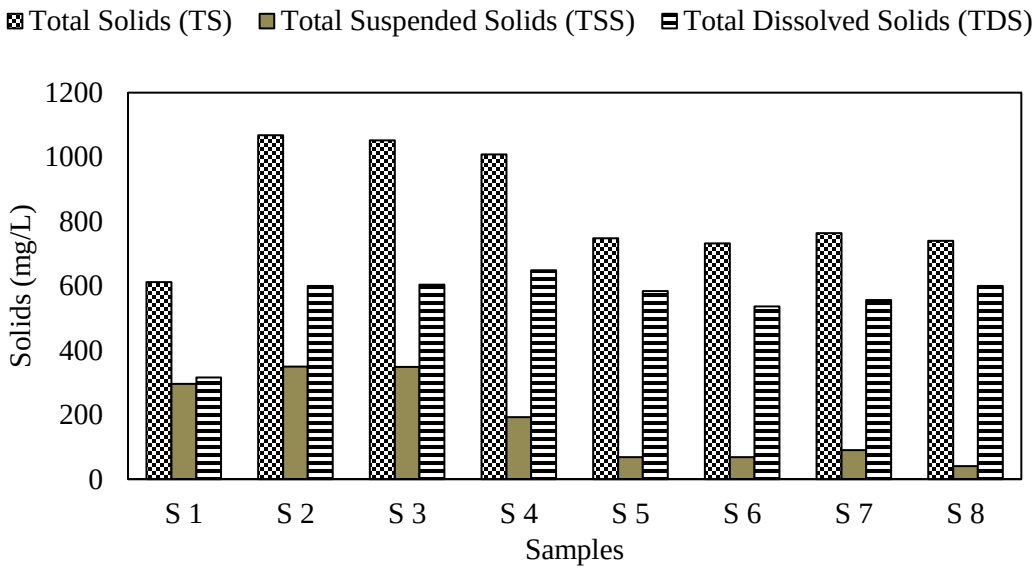



**Figure 8.** Solids profile (TS, TSS and TDS) for the collected samples

The treatment system is effective in removing suspended solids. However, there is no net dissolved solids (TDS) removal. The removal of suspended solids resulted in the removal of total solids from 1000 mg/L to 740 mg/L. The TDS profile also shows that there is a slight increase in TDS in samples S8. The increase maybe due to either leaching of ions from the saturated filtration unit or due to chlorination. The volatile and fixed solid profiles were analyzed for samples S1, S2 and S8.

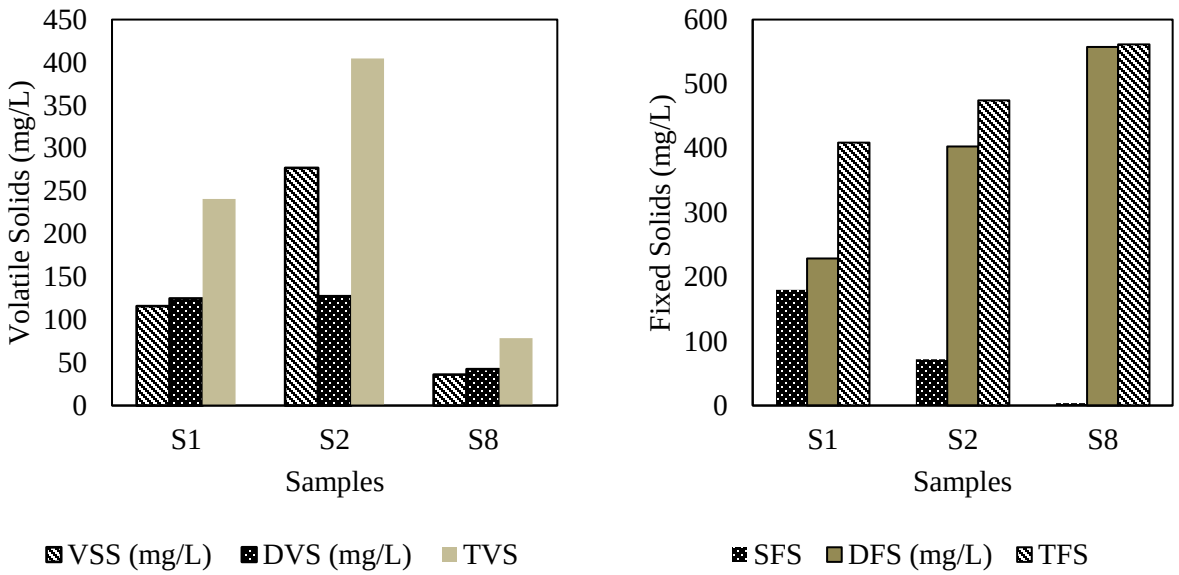



**Figure 9.** Volatile and Fixed solids profile in the collected samples

From Fig. 9 it can be inferred that the suspended solids constitute the major portion of volatile solids in S1 and S2. The dissolved volatile solids decrease from 127.5 mg/L to 42.5 mg/L in sample 8 as a result of secondary and tertiary treatment units. In contrast to dissolved solids, fixed solids profile is showing an increasing trend from the initial value of 408 mg/L in S1 to 561.5 mg/L in S8, respectively. The reason for this increase is same as that of EC and TDS.

### 3.3. Chemical Parameters

Variation of bulk organic parameters, cations and anions of the collected samples are discussed in this section. Fig. 10 shows the variation of COD and BOD of the samples collected from different treatment units of STP. The BOD/COD ratio is 0.45 which suggests that the wastewater is suitable for biological treatment. The values of both BOD and COD are getting reduced after the secondary treatment making the ratio 0.36. This shows us that the carbonaceous organic matter is getting removed in the secondary treatment. However, there is an increase in this ratio to 0.82 after secondary clarifier. This may be due to unsettled microbes in the clarified effluent. These unsettled suspended organic matters are removed in the filter feed tank, PSF and ACF that results in the reduction of the BOD and COD (ratio of 0.52) in the final effluent sample (S8).

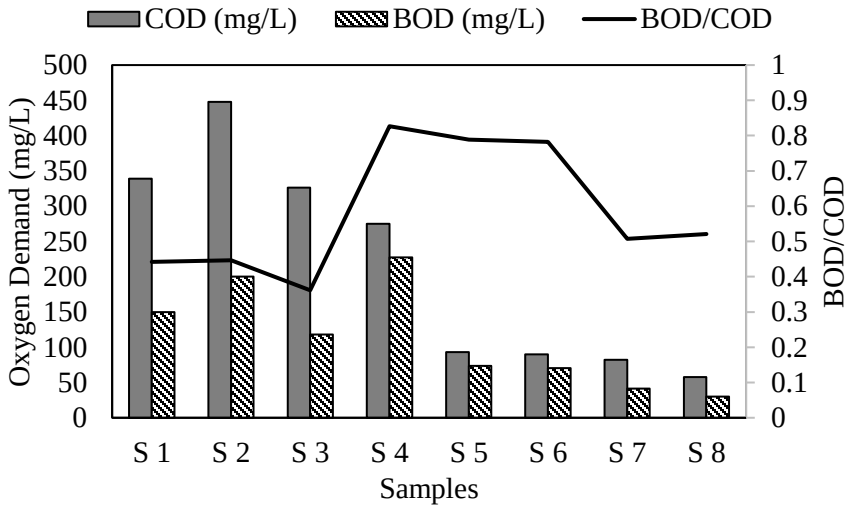



**Figure 10.** Chemical oxygen demand and Biochemical oxygen demand of the collected samples

Fig. 11 shows the concentration of ammonium, nitrate and total nitrogen concentration of the collected samples. It can be inferred that the ammonium concentration is around 13 mg/L whereas nitrate concentration is 0.6 mg/L for the sample in the collection tank. After secondary treatment most of the ammonium ions in the system should be converted into nitrates. However, in this case the nitrification process is minimal as the nitrate and the ammonium concentrations are almost constant in all the samples collected in different treatment units.

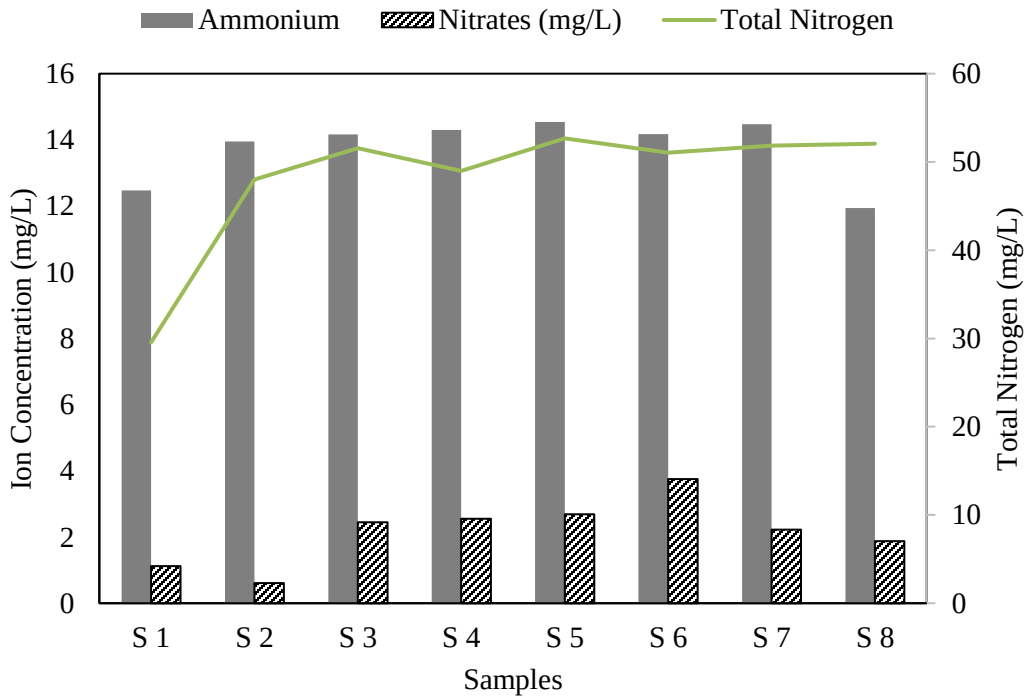



**Figure 11.** Variation of ammonia, nitrates and total nitrogen in the collected samples

Moreover, it can also be observed that the total nitrogen value is constant throughout the entire treatment scheme. However, there is a reduction in ammonia concentration in S8 from 14.5 mg/L to 12 mg/L owing to chlorination. Therefore, the chlorine added is fully utilized for ammonia oxidation rather than disinfection.

Fig. 12 shows the variation of phosphate and chloride ion concentrations in the collected samples. Phosphate concentration is almost similar for S2, S3 and S4. However, the concentration increased to ~30 mg/L after PSF. It is envisaged that the increase might be due to the leaching of phosphates from the saturated bed of the filter. Chloride ion concentration varied less significantly till S7 and was around 115 mg/L. The concentration of chlorides increased to 144 mg/L in S8 owing to the chlorination process. However, the absence of residual chlorine (Tables 5) and the presence of coliforms in the final effluent infers that the chlorine dosage is not sufficient to carry out complete disinfection.

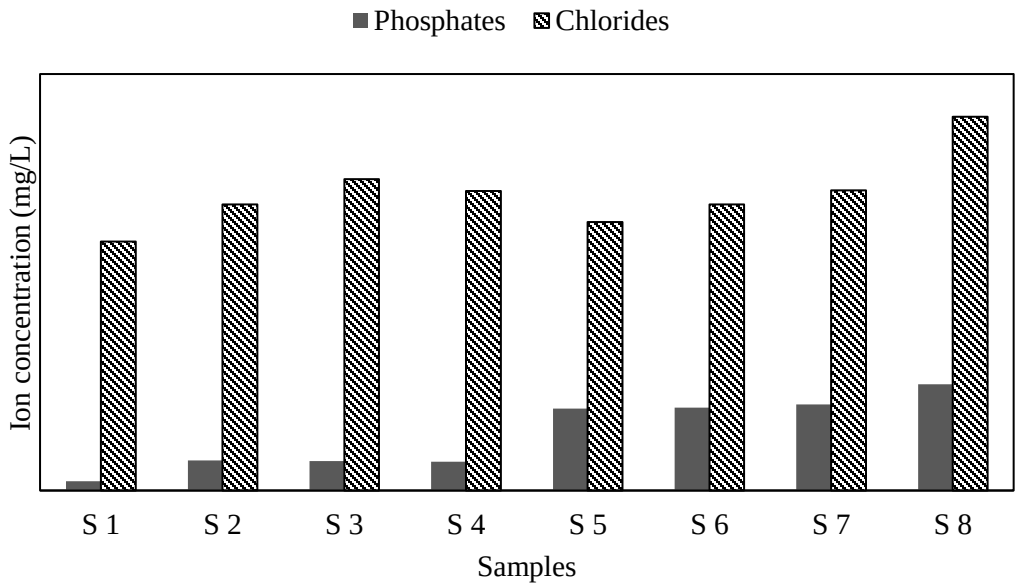



**Figure 12.** Variation of phosphate and chloride concentrations in the collected samples

# CHAPTER 4

# NOISE MONITORING

### 4.1 Instrument used for noise monitoring

The sound levels were monitored using a pocket level sound meter Lutron SL -4030 which has an accuracy of 0.1 dB and can measure up to a maximum value of 130 db. There are two weighting scales namely “A” and “C” in the instrument. Typically, A weighting is used for most of the measurements and B scale weighting is used for the sound measurements from machineries. “A” scale weighting was used for the noise monitoring carried out in this study. Fig. 13 shows the noise meter which was used in this study.


**Figure 13**. Lutron SL 4030 used for measuring sound levels

### 4.2 Methodology adopted for noise monitoring

The noise monitoring is carried out by taking sound levels in and around the treatment plant at specific locations and comparing it with the standard values. The places which were closer to the STP were chosen for monitoring considering the fact that these places will be receiving the maximum sound from the STP. Fig. 14 shows the locations chosen for noise monitoring in and around STP in EFM.

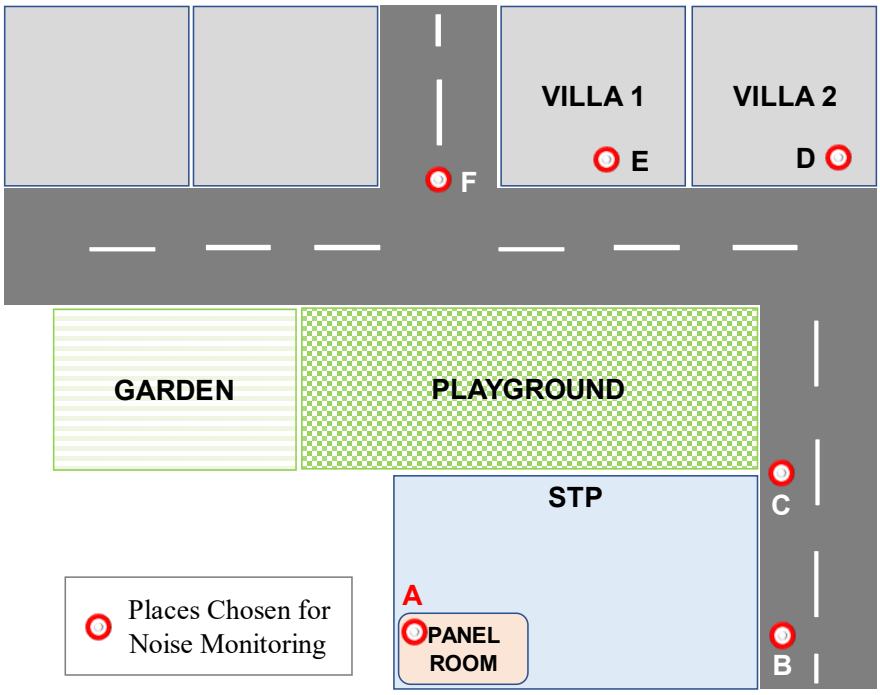



**Figure 14.** Diagram showing places chosen for noise monitoring

Three different scenarios were considered for noise monitoring and they are as follows:

- Entire plant shutdown (All blowers and pumps are turned off)
- All pumps in operation and blower switched off
- All pumps are switched on and also the blower in operation.

In all the above-mentioned cases, sound values were taken at different locations (Fig. 14). The locations were chosen in such a way that they are very closer to STP since these places will be receiving the maximum sound from the STP. The sound values at chosen locations and comparison with standards prescribed by TNPCB (Ministry of Environment, Forest and Climate Change notification S.O 123 (E) dated 14.2.200) are given in Table 6.

**Table 6.** Sound levels of chosen locations for noise monitoring at EFM STP

| Sl. No. | Scenarios considered for monitoring | Measurement location | Noise level (dB) | Noise standards for residential area (dB) |
|---|---|---|---|---|
| 1 | Full-shut down of the plant | Panel room of STP (A) | 60-61 | - |
| | | STP Entrance (B) | 60-61 | - |
| | | End of Ground (C) | 45-46 | 55 |
| | | Villa 2 (D) | 48 | 55 |
| | | Villa 1 (E) | 47 | 55 |

| | | | | |
|---|---|---|---|---|
| | | T-Junction in housing area near STP (F) | 45 | 55 |
| 2 | All pumps in operation but blowers OFF | Panel room of STP (A) | 89-91 | - |
| | | STP Entrance (B) | 56 | - |
| | | End of Ground (C) | - | 55 |
| | | Villa 2 (D) | 48 | 55 |
| | | Villa 1 (E) | 49.1 | 55 |
| | | T-Junction in housing area near STP (F) | 49-51 | 55 |
| 3 | All pumps in operation and blower are ON | Panel room of STP (A) | 90-91 | - |
| | | STP Entrance (B) | 75-76 | - |
| | | End of Ground (C) | 59-60 | 55 |
| | | Villa 2 (D) | 53 | 55 |
| | | Villa 1 (E) | 53 | 55 |
| | | T-Junction in housing area near STP (F) | 51.5 | 55 |

From Table 6, it can be inferred that the noise levels at the different locations inside the gated community is well within the limits prescribed by TNPCB. Although the sound levels are within the limits in the residential points, the sound values inside the plant were quite high. However, it can be reduced by the use of sound adsorbers or barriers inside the plant. In order to reduce the sound levels blowers with less rotations per minute (rpm) can be used instead of the one with higher rpm. If the above said measure is not giving significant reduction in sound levels, blowers can be replaced with submersible ejectors.

# CHAPTER 5

# MAJOR OBSERVATIONS AND RECOMMENDATIONS

## 5.1 Major Observations

A team from IIT Madras visited the STP of Elysium Flushing Meadows and collected the samples from different units of STP. The following major observations were found out based on field visit and detailed analysis of the STP samples.

- The size of various treatment units adopted in the STP are adequate to treat the wastewater generated in Elysium Flushing Meadows. Therefore, no change in dimensions/sizing of the unit are required for the existing treatment units.
- The pH, BOD, COD and TSS values of the treated wastewater (i.e., effluent from the STP) is below the disposal standards prescribed by TNPCB.
- The Fecal Coliforms (FC) in the treated wastewater was >1600 MPN/100 mL, which is due to insufficient hypochlorite dosage. However, the level of FC is lesser than permissible value of 10,000 MPN/100 mL.
- The treatment units were not effective in achieving the nitrification process and due to which ammonia concentration is almost similar in the inlet and outlet wastewater.
- Phosphate concentration in the treated water is higher than the inlet concentration, which might be because of the leaching of ions from PSF and ACF.
- There were no signs of the usage of sludge drying beds that has to be used for drying the screenings and excessive sludge from ASP.
- The measured noise levels at different residential locations closer to the STP are well within the limits prescribed by TNPCB.

## 5.2 Recommendations

Based on the overall findings, the following recommendations are given for the improvement of the treated water quality and the overall performance of the STP:

- The conductivity as well as the TDS of the wastewater were increasing after the filtration process, which may be due to the leaching of ions from the PSF and ACF. Therefore, (a) PSF must be maintained properly to sustain the quality of the filtrate, which can be done by making frequent and appropriate backwashing of the filter bed, and (b) ACF should be cleaned chemically or refilled with new adsorbent to maintain the quality of the filtered water.

- Suitable dosage of hypochlorite must be given to the effluent after ACF to maintain the minimum residual chlorine dosage of 1 ppm. A chlorine contact time of 20 to 30 min must be ensured to reduce the level of FC in the STP effluent.
- Although the treated wastewater is meeting majority of the disposal standards, the detailed solids analysis (TSS, TDS, TFS and TVS) along with other parameters revealed that the present treatment plant failed to achieve the CPHEEO standard for gardening. Therefore, along with already suggested measures, appropriate units such as ultrafiltration (UF) should be added in the tail end of the STP to improve the quality of the treated wastewater.
- Electromagnetic flow meter should be installed at the inlet and the outlet of the STP. Moreover, a dedicated book of records for the STP should be maintained.
- Units such as secondary settler, filtration holding tank and effluent tank should be provided with platforms for improving the ease of access for monitoring purpose.
- The scrap/unwanted materails stored in the storage room should be cleared from the instrumentation/panel room, and suitable fire-fighting devices should be equipped within the STP.

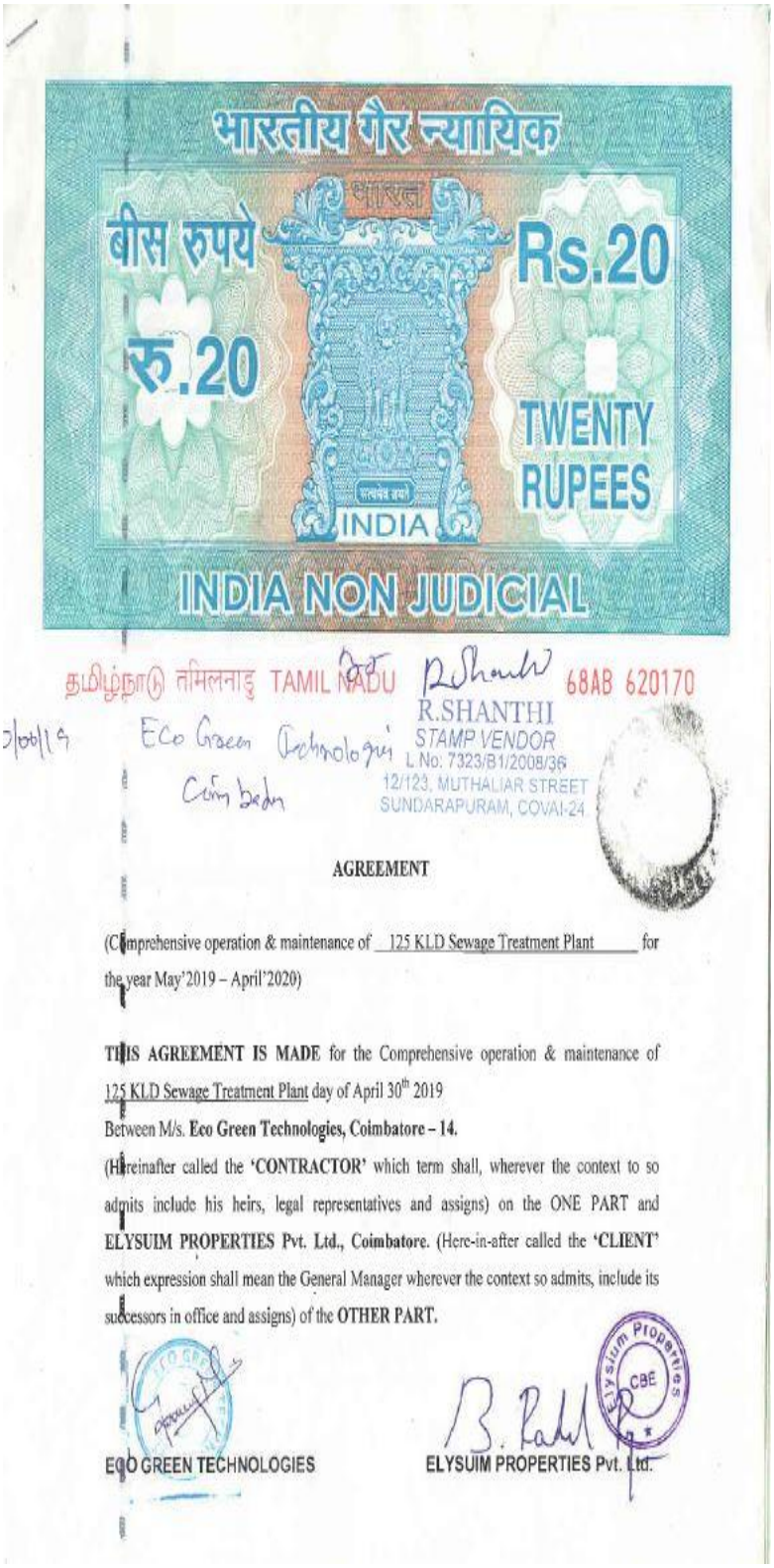
## 5.3 Conclusions

The physical dimensions of the various treatment units existing at present in the STP are adequate to treat the wastewater generated in Elysium Flushing Meadows. The BOD/COD ratio of the raw/influent wastewater indicates the suitability of the biological process-based treatment scheme adopted in the STP of EFM. Moreover, the effluent coming out of the STP is meeting most of the standards prescribed by TNPCB except FC and total phosphorous. The standards can be met if the recommendations pertaining to chlorination, ACF and PSF are practiced systematically in everyday STP operation. Moreover, the measured noise levels at different residential locations closer to the STP are well within the limits prescribed by TNPCB.

# ANNEXURES

## Annexure I

Agreement signed between EFM and M/s Eco Green Technologies for the operation and maintenance of STP



भारतीय गैर न्यायिक

भारत

बीस रुपये

Rs.20

रु.20

TWENTY RUPEES

INDIA

INDIA NON JUDICIAL

தமிழ்நாடு तमिलनाडु TAMIL NADU 68AB 620170

R.SHANTHI
STAMP VENDOR
L No: 7323/B1/2008/36
12/123, MUTHALIAR STREET
SUNDARAPURAM, COVAI-24

Eco Green Technologies
Coimbatore

**AGREEMENT**

(Comprehensive operation & maintenance of 125 KLD Sewage Treatment Plant for the year May'2019 – April'2020)

**THIS AGREEMENT IS MADE** for the Comprehensive operation & maintenance of 125 KLD Sewage Treatment Plant day of April 30th 2019

Between M/s. **Eco Green Technologies, Coimbatore – 14.**

(Hereinafter called the **'CONTRACTOR'** which term shall, wherever the context to so admits include his heirs, legal representatives and assigns) on the ONE PART and **ELYSUIM PROPERTIES Pvt. Ltd., Coimbatore.** (Here-in-after called the **'CLIENT'** which expression shall mean the General Manager wherever the context so admits, include its successors in office and assigns) of the **OTHER PART.**

ECO GREEN TECHNOLOGIES

ELYSUIM PROPERTIES Pvt. Ltd.

The Contractor shall get comprehensive insurance of the Plant on its own, covering all risks.

The Contractor shall be solely responsible for complying /observing all existing laws like Labor, EPF, TNPCB Teams and condition, Safety regulations etc. as amended from time to time.

Force Majeure: In case of any calamity like Earthquake, Lighting, Cyclone, War, Civil disturbance, Riots, Strikes, Lockouts which cause delay /suspension in the operation of the Plant, it shall be considered by appropriate authority for granting time for resuming the operation of the Plant. No other claim, whatsoever will be entertained by the appropriate authority.

All Our Output water Parameters after the treatment would attain as prescribed by the TNPCB.

## SCHEDULE-A

**Operations and Maintenance (Comprehensive)**

**List of Plants and Equipments at your site**

| S. No. | Plant & Equipments | Quantity |
|---|---|---|
| 1 | Sewage Treatment Plant 125 KLD | 1 |

**Eco Green Technologies Scope of Service Includes:**

1. Regular change of Oil for Air Blower
2. Service of any sudden brake down of pumps
3. Hypo Dosing for Post Treatment
4. Cleaning of STP Premises
5. Providing of Bio – Culture for maintaining of MLSS.

## SCHEDULE - B

**O & M - Scope of Client**

| S. No. | Service Description |
|---|---|
| 1 | In case of shutdown in EB/ power cut client will provide alternate power (DG) |
| 2 | Reusing of treated Sewage water for gardening. |

ECO GREEN TECHNOLOGIES

ELYSUIM PROPERTIES Pvt. Ltd.

## Annexure II

TNPCB analysis reports on EFM STP samples in the years 2020 and 2021

**UNIT PROCESSES ON 04.08.2021.**

11. It is respectfully submitted that the Analysis results of samples collected from various unit processes by the Joint Committee on 04.08.2021 is tabulated below:

Table 2: Analysis results of samples collected from various unit processes.

| Parameters | Inlet: sewage collection tank | Aeration tank | Outlet: after dual media filter | Discharge limit |
|---|---|---|---|---|
| pH | 7.76 | 7.62 | 7.77 | 5.5-9.0 |
| TSS (mg/l) | 438 | 1970 | 10 | 50 |
| BOD (mg/l) | 114 | 37 | 5 | 30 |
| COD (mg/l) | 288 | 160 | 48 | 150 |
| Fecal Coliforms (MPN/100 ml) | 3100 | 330 | 9.2 | Desirable-1000 Permissible-10000 |
| Total Coliforms (MPN/100 ml) | 6300 | 1100 | 26 | - |
| NH4-N (mg/l) | 53.8 | 35.3 | 7.3 | - |
| Total Nitrogen (mg/l) | 1.86 | 2.68 | 3.29 | - |

ADDL. CHIEF ENVIRONMENTAL ENGINEER
TAMIL NADU POLLUTION CONTROL BOARD

6

TAMILNADU POLLUTION CONTROL BOARD,
ADVANCED ENVIRONMENTAL LABORATORY,
COIMBATORE – 641 030.

Accredited Laboratory – (ISO/IEC 17025:2005) NABL – TC-7025

(19)

## REPORT OF ANALYSIS

ULR-TC702520000000371F

**Report No** : 348, 349, 350.
**Report Date** : 04.09.2020.
Analysis starting Date : 18.08.2020.
Analysis Completion date : 04.09.2020.
Code No & Point of Collection
Date of Collection : 18.08.2020.
1. PR-309 – STP Inlet [Untreated]
Date of Receipt : 18.08.2020.
2. PR-308 – Aeration Tank [Treated]
Sample Condition : Sealed
3. PR-310 – STP Outlet [Treated]
Sample Quantity : 2.5 Litres
Sample Collected and Requested by : Dr.P.R.Ramesh, AE.,
O/o.The District Env.Engineer
No.5, Ramasamy Nagar,
Kavundampalayam (Post),
Coimbatore – 641 030.

| Sl. No | Parameters | Test Method | Unit | Sample-1 PR-309 | Sample-2 PR-308 | Sample-3 PR-310 |
|---|---|---|---|---|---|---|
| 1 | pH @ 25° C | APHA 23rd Edi.2017 4500 – $H^+$ | --- | 7.23 | 7.55 | 7.09 |
| 2 | Total Suspended Solids | APHA 23rd Edi. 2017 – 2540 – D | mg/l | 132 | 486 | 10 |
| 3 | BOD for 3 days @ 27°C | IS 3025 – 1993, Reaff – 2009 | mg/l | 44 | 62 | <2 |
| 4 | COD | APHA 23rd Edi.2017 – 5220 - B | mg/l | 272 | 312 | 8 |
| 5 | Ammonical Nitrogen | APHA 23rd Edi.2017 – 4500 NH3 | mg/l | 48.7 | 42 | <2.0 |

**Remarks:**

< - Indicates less than minimum detectable limit.

4/9/2020
J.E.S

for 4/9/2020
Assistant Director (Lab),
AEL – TNPCB – CBE.



*3rd & 4th Floor, No.5, Ramasamy Nagar, Kavundampalayam, Coimbatore – 641 030.*
*Telephone: 0422 – 2440174, Email: deltnpcbcbe@gmail.com, aeltnpcbcbe@gmail.com*

## Annexure III

**Table A1.** Characteristics of samples collected during second sampling

| S. No | Parameter | Before screening | After screening | Aeration tank | Effluent |
|---|---|---|---|---|---|
| **1.** | **pH** | 6.52 | 6.49 | 6.73 | 7.65 |
| **2.** | **EC** | 586 | 602 | 782 | 1121 |
| **3.** | **Turbidity** | 67 | 190 | 598 | 7.8 |
| **4.** | **TS** | 486 | 954 | 4880 | 1143 |
| **5.** | **TSS** | 89 | 335 | 2870 | 26 |
| **6.** | **VSS** | 58 | 321 | 1830 | 18 |
| **7.** | **TDS** | 477 | 533 | 2035 | 1117 |
| **8.** | **DVS** | 167 | 133 | 408 | 87 |
| **9.** | **DFS** | 310 | 400 | 1627 | 1031 |
| **10.** | **TVS** | 224 | 454 | 2239 | 97 |
| **11.** | **SFS** | 5.3 | 93 | 870 | 8 |
| **12.** | **TFS** | 262 | 500 | 2641 | 1047 |
| **13.** | **SVS** | 83 | 242 | 2000 | 18 |
| **13.** | **COD** | 214 | 442 | 3024 | 24 |
| **14.** | **BOD** | 93 | 226 | 126.3 | 29.7 |
| **16.** | **TN** | 32.6 | 32.6 | 91.4 | 27.5 |
| **17.** | **Nitrates** | 1.03 | 1.01 | 2.70 | 4.52 |
| **18.** | **Ammonium** | 23.8 | 36.3 | 81.6 | 29.1 |
| **19.** | **Phosphates** | 13.8 | 14.7 | 126.7 | 7.13 |
| **20.** | **$Ca^{2+}$** | 16 | 32 | 22.4 | 128 |
| **21.** | **$Mg^{2+}$** | 37.4 | 24 | 52.8 | 32.64 |
| **22.** | **Residual Chlorine** | - | - | - | BDL |
| **23.** | **TC** | $26x10^6$ | - | - | 7000 |
| **24.** | **FC** | $26x10^4$ | - | - | 900 |

Note: All units are in mg/L except pH, EC (µs/cm), TC (MPN/100 mL) and FC (MPN/100 mL)

## Annexure IV

Pictures taken during site visit and sample collection

**STP ENTRANCE AT EFM**

**WATER LOGGING INSIDE STP**

**PANEL ROOM IN EFM STP**

**PERFORATED PLATE TYPE SCREEN**


**STP INLET FLOW METER**


**UNSAFE ACCESS TO FILTER FEED TANK**


**BLOWER FOR AERATION TANK**

**SOLIDS IN THE SECONDARY CLARIFIED EFFLUENT**