# STP FEASIBILITY REPORT (HT-SBR)

**Date of Submission: 09-05-2022.**

# SEWAGE TREATMENT PLANT Cap- 700 KLD

## Project Report - Sewage Treatment Plant

## INTRODUCTION

M/s. MVN Athens,Sector-05 Sohna, District-Gurgaon, Haryana ,
have proposed residential development at Sector-05 Sohna, District-Gurgaon, Haryana With a view to conserve fresh water resources and adopt re cycle and re-use measures. They propose to set up a water pollution control and re-use system for the wastewater generated from entire complex and also proposed to harvest and recharge ground water as storm water management. The only source of wastewaters is from toilets, pantries and washbasins and washrooms therefore domestic in nature. One number of STP has been proposed for the entire Residential Apartments & Villas.

This report details the following from the proposed facility. Collection, treatment and Disposal of Domestic Effluents.

## QUANTITY AND QUALITY OF WASTEWATERS

The wastewater quantity from domestic sources is considered at maximum of 85% of water consumed. Hence the quantity of wastewater generated is as below

Total Quantity of wastewater generated = 700.00KLD

1 No Sewage Treatment plant for treating sewage has been proposed with capacity of 700.0 Cum/day respectively.

The **Advanced Sequential Bio Reactor treatment process (SBR)**

### *1.1 Plant Capacity*

The sewage treatment plant is designed to treat 700 $m^3$/day of domestic sewage. The plant is designed to operate at a flow rate / stream of 35.0 m3/hr in 20 hours operation. The SBR system is designed on the following basis: -

| Particulars | Typical value |
|---|---|
| Flow /Stream | 35.0 cum/hr |
| No of Streams | 1 Nos |
| Nature of Waste | Domestic Sewage |
| Total Plant Area | 400m2 |
| Total Plant Depth | 10m |

## *1.2* Water Quality

The Sewage Treatment Plant (STP) receives raw sewage water to the Bar Screen followed by raw sewage collection Sump. The plant is designed to take care of sewage treatment applications for 700 $m^3$/d flow. The operating characteristics of the plant are as follows:

**Table 1: Typical Water Quality in Bioreactor**

| Parameters | Range |
|---|---|
| Flow / Stream | 35.0 m3/day |
| No of streams | 1 Nos |
| Nature of Waste | Domestic Sewage |
| pH | 5.5 - 7.5 |
| $BOD_5$ | 200 - 250 mg/l |
| COD | 400 - 600 mg/l (Max) |
| TSS | 30-50 mg/l |
| Oil and Grease | 30-50 mg/l (max) |

Oil and grease removal is ensured by properly designed grease trap and oil skimming method adopted in the plant.

***Treated Sewage Quality***

**Table 1: Typical Water Quality at outlet end.**

| Parameters | Range |
|---|---|
| pH | 6-8.0 |
| $BOD_5$ | Less than 10 mg/l |
| COD | Less than 50 mg/l |
| TSS | Less than 10 mg/l |
| Oil and Grease | Less than 20 mg/l |
| E-Coli | Nil |

**DURATION OF OPERATION**

The entire system will operate for 20 hrs, as needed, for the treatment of

***700 $m^3$ / day. All pumps and blowers will be provided with standby.***

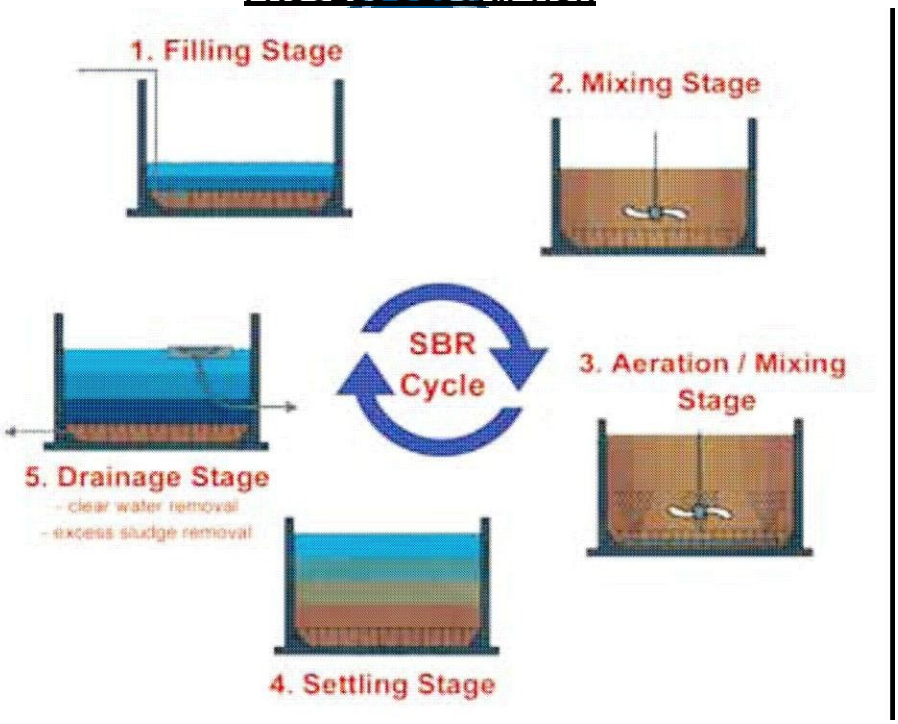
## ***Process Design Description***

**Pre-treatment**
Raw wastewater entering the STP must be screened with a bar screen of size 10-25 mm before entering the bioreactor portion of the SBR process to remove coarse aggregates, etc.

***Grease Trap***
Fat, oil and grease will effect the process and also effects quality of treated water. Hence an effective grease trap system (Like Hydro Treat Belt Type Oil Skimmer) must be incorporated at the inlet end before the bar screen chamber in order to remove oil and grease to treatable limits.

**PROCESS DESCRIPTION FOR ADVANCED SEQUENTIAL BIO- REACTOR (SBR)**

**PROCESS DESCRIPTION**




**SCREENING**
Sewage is directed into a bar screen chamber for removal of floating material such as grass, polythene bags etc. A manual coarse-bar-screen is provided for separation, thereby protecting the subsequent process equipment from damage and improving the reliability and effectiveness of the process.

**OIL & GREASE REMOVAL**
Oil in sewage forms scum and can interfere with the biological process. Sewage from bar screens passes through the Oil & Grease Trap for removal of Oil, Fats or other greasy matter form sewage.

**AERATION, CLARIFICATION & DECANTING**

There is two no's of Reactor in which sewage undergoes unit operations of Aeration, Settlingand Decanting.

Reactor is a self-contained system incorporating equalization, aeration and clarificationwithin the confines of a **SINGLE** basin for Each Reactor. It uses a state-of-the-art Biomass Conditioning technology, which enables the system to attain nutrient control without the addition of chemicals and to outperform continuous "flow through systems". All the treatment processes take place in the reactor tank thus eliminating the need for clarifiers. This process treats the wastewater in a batch mode and each batch is sequenced through a series of treatment stages.

The process follows five basic stages :

**1) FILL**
**2) REACT**
**3)SETTLE**
**4)DECANT**
**5)IDLE**

The actual cycle time will vary with the effluent results desired. If only BOD reduction is desired, a cycle time of 3 hours may be used. All the three phases are logically time- controlled.

**Typical Cycles:**

**FILL** **:** The influent wastewater is distributed into the sludge blanket and can take place under mixed or unmixed conditions and aerated or un-aerated conditions.

**REACT** **:** This includes mixing and aeration. Aerated conditions serve to oxidize organiccarbon, nitrify ammonia, and promote uptake of phosphorus in the sludge. Un-aerated conditions promote de-nitrification of nitrite and nitrate.

**SETTLE :** During this cycle, all mixing and aeration is turned off and the mixed liquor Solids settle, allowing a clear supernatant to form in the upper part of thetank.

**DECANT :** The decant event occurs after a substantial depth of supernatant has formed .Automatic valves open and supernatant is drawn off the upper portionof the tank. Sludge wasting can occur during this time, because the settled sludge bed would attain a maximum concentration of solids.

**IDLE** **:** This is a unique stage which helps is acclimatisation for the biomass for the fill Stage and also helps in the reduction of Phosphorous.

**DISINFECT :** Done using a highly effective Chlorination system which does not leave an residue after the reaction.

❖ **General:**

The duration of the various steps is controlled by Manually with Valves. The timing of each step is preset by Operators Present at site. The timings of the steps of chemical cleaning arealso set By Operators Present at site. The duration of various steps can be changed by Operators Present at site..

Each step of the operation can be set and monitored from the operator. Interface located on the panel.

The operational control of the plant and its monitoring is carried out through anumber of graphic screens provided on the operator station. The screens include time settings, elapsed time of each step of operation, shut down valve status, etc.

Following are description of individual treatments units, with their sizes and Mechanical Equipments required.

**DESIGN CALCULATION OF TREATMENT UNITS**

**Flow : 700 KLD**

1. **Bar Screen Chamber**

Flow = $\frac{700}{20}$ = 35.0 $m^3$/hr

Say 35.0 Cum/hr

Factor of safety = 1.5 ; Design flow = 35 x 1.5 = 52.5 $m^3$/hr &

$\frac{52.5}{60 \times 60}$ = 0.0145 $m^3$/sec

Function : to eliminate Solids > 20 mm

Coarse Screen and Fine Screen total No. = 1 No.

Inflow velocity = 0.45 m/sec

Angle of Inclination = 60º

Clean opening a) Coarse Screen – 25 mm

b) Fine Screen –10 mm

Cross Section of Screen Chamber = $\frac{0.00166}{0.45}$ = 0.00368 Sqm

**2. Equalization Tank**

Average flow = 700 $m^3$ / stream / day

Peak flow 700 $m^3$ / day @ 24 hrs flow duration

Flow = $\frac{700}{24}$ = 35.0$m^3$/hr

Say 35.0 Cum/hr

Keeping 8.6 hrs detection period

Volume of tank = 35.0 x 8.6 = 301.0$m^3$

Provide Size per tank = 25.2 Sqm x 5.5 m SWD

To suit accommodate the space available @ site.

**3. Bio-Reactor (SBR)**

The following design assumptions and conditions are considered.

No. of Bio-reactors = 2 Nos.

Liquid depth = 4.5 m

Decant depth is 33% of the total water depth = 1.48 m

Overall hydraulic retention time = 20 hrs

F/M = 0.1

MLSS = 2400 mg/lit

Total volume of the reactor = $\frac{240 \times 240}{0.1 \times 2400}$ =

Say = 240 cum

Provided Each reactors of 240Cum (4m SWD) – 2 Nos.

Check for Detention time = $\frac{\text{Volume of the Reactor}}{\text{Design flow}}$

= $\frac{240}{24.0}$ = 10.0 hrs (Hence ok.)

Total cycle time = time fill + time aeration + time decant + time settling/

= 2 + 3 = 5 hrs

Number of cycles/tank/day = $\frac{24 \text{ hrs}}{}$ = 5 cycles/tank/day

4.5 hrs/d

Number of cycles /day = 4.5 cycles/day

Fill volume/ cycle = $\frac{700}{4.5}$ = 155.55 m3

**a) Oxygen requirement**

Organic Load (kg of BOD) = 700 KLD x 0.250 = 175 kg / day

Oxygen requirement = 2 time of organic load.

= 2 x 175 = 350 kg / day

Considering $O_2$ diffusion rate @ 18gm / $m^3$ of air volume per running „M" of depth of water and considering 60% efficiency of air blower and at working 24 hrs / day.

Air requirement for SBR Tank = $\frac{700 \times 1000}{24 \times 18 \times 4.5 \times 0.6}$ = 600.13 m3/hr

Air required for Equalization tank = 0.9 X Volume of Equalization Tank

= 0.9 x 300

= 270 $m^3$ / hr

Air required for Sludge Holding tank = 0.3 X Air required for ET

= 0.3 X 71.2

= 21.36 m3/hr X Detention time X 0.9

= 21.36 x 2.2 x 0.9

= 42.29 m3/hr

Total air required (m3/hr) 600.1+270.0+42.29= 912.42

There fore Provided 3 Nos air blower each 500 $m^3$ / hr @ 5000 MMWG - (2 Working + 1 SB)

**b) Fine Bubble diffusers**

No. of fine bubble diffusers of 1 m long required @ the air distribution rate of 8 m3/hr/m length of diffuser as discharge rate.

Running Meters = 601 / 8 = 74 Rmts, Provide 37 Rmts in each tank

**1. FILTER FEED PUMPS**

Flow = 700 $m^3$ / day

At 20 hrs Working

Flow = 700 / 20 = 35.00 $m^3$ / hrs.

Provide 35.0 $m^3$/hr @ 20 m head.- (1Working + 1SB)

Type of Pumps - Horizontal Centrifugal, close impeller.

**2. PRESSURE SAND FILTER**

Considering rate of filtration @ 35 $m^3/hr/m^2$

Therefore provide 1 No. each 1.5 m dia filter.

Type – Vertical, sand filters

Media - Pebbles, Gravel, Sand

**3. ACTIVATED CARBON FILTER**

Provide 1 Nos. each 1.5 m dia

Type – Vertical, Carbon filter

Media - Pebble, Gravel, sand and Activated carbon granules of 500 grade.

**4. SLUDGE RECIRCULATION PUMPS**

Flow - 10$m^3$ / hr @ 10 m head

Qty - 1 No.

Type – Horizontal, non-clog, centrifugal, open impeller

**CHLORINATION**

Chemical type – Liquid Hypo chlorite

Dosage = 4 to 5 mg / ltr.

Chlorine required per day = 0.8 x 2 = 1.6 kg / day

Dosing pump required @ 20 hrs working = $\frac{1.6 \times 700}{20}$ = 56.0 gm / hr

Type of Chlorine dozer pump = electronic dosing

Capacity – 1 to 4 LPH @ 4.0 kg / $cm^2$ pressure.

## 7. FILTER PRESS

### a. Filter Press

Type - Recessed type, hydraulic closing manual operating system

Size : 600mm X 600mm

M.O.C. - Polypropylene, plates - 24 Nos.

Test pressure - 5 kg / $cm^2$

Closing pressure - 200 to 250 kg / $cm^2$

Filter Cloth - PP, 5-micron size

No. of units - 1 No.

### b. Screw Pump

Filter Press Feed Pump type - Screw Pump

Capacity - 3.0 $m^3$ / hr @ 40 m head

Qty - 1 No.