# Designing & Implementation of 375CMD & 220CMD Capacity Sewage Treatment Plant

## Using

## Phytorid System

## *Technical Proposal*

Submitted by

technogreen environmental solutions
your future, our care

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## 1.0 DESIGN PARAMETERS

**Type of Effluent** : Sewage

**Sources** : Domestic from housing sector in decentralized manner divided into 2 different clusters i.e. **Kaveri (001 - 003) + Club House** = 375 & **Narmada (001 - 005)** + School = 220CMD

## 12.0 *PARAMETER AND THEIR CONCENTRATION CONSIDERED FOR THE DESIGNING & IMPLEMENTATION*

| Sr. No. | Parameters | Existing effluent Characteristics | Final Treated effluent | Unit |
|---|---|---|---|---|
| 1. | Flow | 375 / 220 | 360 / 210 | **CMD** |
| 2. | pH | 7.0 – 8.0 | 7.0 to 8.5 | -- |
| 3. | Suspended Solids | 400 – 500 | 20 – 30 | **mg/l** |
| 4. | Chemical Oxygen Demand | 300 – 400 | < 50 | **mg/l** |
| 5. | Biochemical Oxygen Demand | 150 - 200 | < 10 | **mg/l** |
| 6. | Oil & Grease | 25 – 30 | < 10 | **mg/l** |
| 7. | Total Dissolved Solids | 1000 – 1100 | <1100 | **mg/l** |

## 2.0 DESIGN PHILOSOPHY

### *2.1 DESIGNING OF SYSTEM*

Considering the type of sewage and the treated sewage characteristics required system has to be selected to achieve the desired results. We have proposed treatment includes primary settling followed by constructed wetland system and augmented with tertiary filtration system

### *2.2 PROCESS TECHNOLOGY & FEASIBILITY OF TREATMENT*

#### 2.2.1 Waste Water Treatment Scheme

The Sewage Treatment Plant shall be employed to remove / reduce suspended and colloidal solids, color, COD, BOD and Oil & Grease so as to get treated sewage of a quality acceptable to subsequent discharge standards prescribed by State PCB. The main units of the proposed Sewage Treatment Plant are discussed in the following sections

#### 2.2.2 Collection cum Septic Tank

The sewage from various places will be collected in the collection Tank through sewage collection system designed to connect the typically placed chambers at approximately 15m. Since there is expected to be high diurnal and seasonal variations in temperatures in this region of implementation, it is essential to consider IS 2470 design specifications with high detention times as compared to temperate zones and thereby HRT shall be minimum 1.5days. The sewage shall be drained by gravity into septic tank that shall act as equalization, collection during peak flows as well as primary settling chamber for solids removal.

### 2.2.3 Primary Launder

Primary launder consists of simple flow regulation / equalization mechanism (manifold) to assist equal flow distribution into the wetlands and is only a precautionary measure to avoid any large solids overflowing into the wetland systems which is minimal in this case with aggressively designed septic tank.

### 2.2.4 Constructed Wetland System

The philosophy of treatment scheme proposed is using the conventional solid settling mechanism of physical processes through anaerobic septic tank followed by phyto-systems i.e. wetlands and finally polishing the secondary treated effluent using tertiary process of filtrations.

#### 2.2.4.1 Introduction

Use of plant species along with their root system along with the natural attenuation processes can be combined together to get the Constructed Wetland Technology (Phytorid™). It is one such technological solution, which can be easily implemented in cities as well as in rural areas for treatment of wastewater. The system is based on use of specific plants normally found in natural reed with filtration and treatment capability. This system can be utilized for a wide variety of applications. It can be used for secondary and tertiary treatment of municipal wastewater, sludge management, treatment of industrial or agricultural effluent as well as for the treatment of landfill leachates.

The filterable Constructed Wetland Treatment System is sown with semi-aquatic, aquatic, ornamental, flowering species of plant, where the wastewater flows in horizontal as well as vertical manner to achieve the better efficiency for treatment. These units/ systems are designed in a manner that the first unit mainly removes BOD, phosphorous and also oxidizes nitrogen. The other units is responsible for polishing by removing BOD further, disinfect, and remove or degrades the particles by precipitation, ionic exchange, and / or adsorption processes.

### 2.2.4.2 Objectives of Constructed Wetland System

The main objective of the proposed project is to provide a simple, feasible, practically sound, eco-friendly and cost-effective technology, which can handle the domestic waste treatment leading to use of treated water gainfully.

### 2.2.4.3 Typical Design Features

The general concept design for the Constructed Wetland system is presented in **Figure 1**. However, the design may be further modified as per specifications and land availability.

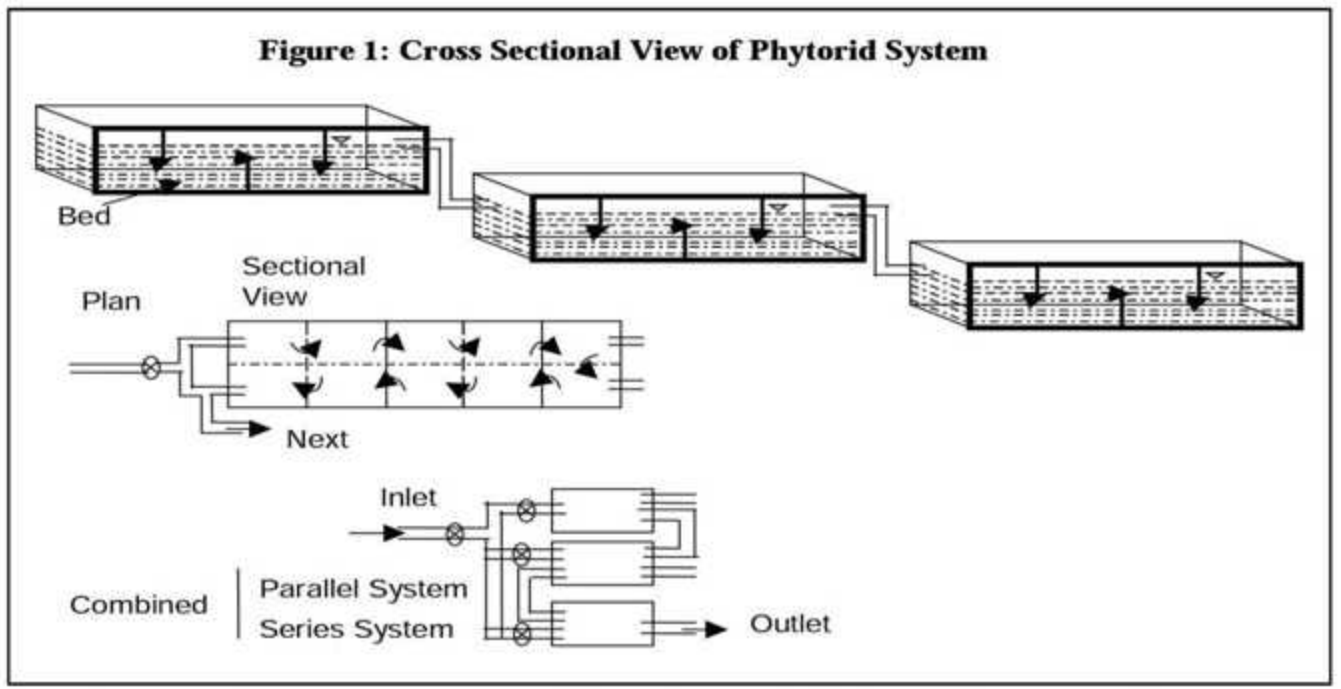


**Figure 1**: General Layout of Constructed Wetland Treatment System

The sub-surface flow type, Constructed Wetland system is proposed for the treatment of domestic wastewater which will consists of a basin or a channel with a barrier to prevent seepage, but the systems/ cells/ beds contain a suitable depth of porous media. A primary treatment facility would also be constructed along with basic for effective removal of solids and thus reduces the marginal BOD.

The porous media also supports the root structure of emergent vegetation. The design of the Constructed Wetland system assumes that the water level in the cells will remain below the top of the filter media.

The vegetation to be utilized for the said Constructed Wetland system is very important. Various species of aquatic plants have been utilized to attain maximum efficiency in the treatment of domestic wastes. These include species like *Phramitesaustralis, Phalarisarundinacea, Glyceria maxima, Typha spp., Scirpus spp., Canna sps., elephant ear sps.*, other common grasses etc. depending up on the local conditions and availability as well as acclimatization potential.

### 2.2.4.4 Advantages of Constructed Wetland Technology

- Treatment efficiencies for the removal of faecal coliforms, BOD, COD, nutrients are up to >95%, which is greater than the traditional methods **without use of any power at all for secondary processes**
- It is a very cost effective technology when compared with the traditional wastewater treatment methods
- Since it utilizes natural vegetation and rhizosphere microorganisms, it is eco-friendly method of treating wastewater
- An important factor to be considered is the aesthetic improvement that is provided by this methodology
- No mosquitoes and odour nuisance being a sub-surface flow system
- The treated water can be used for enhancement of environmental architecture in general or reuse based on requirements
- The quality of treated water is comparable to irrigation standards

### 2.2.4.5 Treatment Efficiency

Constructed Wetland system being natural method, the final efficiencies as indicated in **Table 1** will be achieved after the system is stabilized which may require a period of 6 months after commissioning.

**Table 1** Treatment efficiencies expected to be achieved using Constructed Wetland System

| Parameter | Inlet | Outlet | Achievable Efficiency (%) |
|---|---|---|---|
| BOD (mg/L) | 200 | <30 | >95.0 |
| COD (mg/L) | 300 | < 50 | >95.0 |
| TSS (mg/L) | 500 | <10 | >93.0 |
| TKN (mg/L) | 40 | 15 | >62.5 |
| P (mg/L) | 25 | 12 | >52.0 |
| Fecal coliform (Col/100ml) | $>10^5$ | <1000 | >98.0 |

### 2.2.4.6 Operation and Maintenance

This technology is natural system; as a result operation is mostly passive and requires little operator intervention. Requirement for area can change on various factors such as load (kg BOD/day), ambient temperature, topography of the region, flow characteristics, etc. Maintaining uniform flow across the Constructed Wetland system through inlet and outlet adjustment is extremely important to achieve the expected treatment performance. Sampling of inlet and outlet may be carried out for a period of 1 month every fortnight after stabilization of the treatment systems. Effective training along with O&M manual and debugging shall be done by Technogreen over a period of about a month.

### 2.2.5 Intermediate Collection Tank & Tertiary Filter

The treated sewage from constructed wetland system will be collected in to this tank & passed through PSF & ACF. Here the remaining suspended solids and traces of organics are removed. The polished treated water from the outlet of filters shall flow to Disinfection System.

### 2.2.6 Disinfection System

The most effective and conventional practice of disinfection is use of chlorine either as pure gas, liquid NaoCl or tables forms and still considered to be inexpensive. However, with recent developments in field, UV light has been also deployed to achieve the same effect though limited to point effect effective only in closed pipeline systems.

### 2.2.7 Final Collection Tank

The treated effluent from the tertiary system will be collected in to the final collection tank and from here; treated water will be used for gardening / recycling for non contact purposes.

## 3.0 Technical Specifications

| Description | 375CMD x 1No. (20$M^3$/Hr) | 220CMD x 1No. (12$M^3$/Hr) |
|---|---|---|
| Screen | Capacity – 8.4$M^3$<br>MoC – RCC<br>Size – 7.0m x 1.0m x 1.2m TD<br>(0.2FB) | Capacity – 8.4$M^3$<br>MoC – RCC<br>Size – 7.0m x 1.0m x 1.2m TD<br>(0.2FB) |
| Septic Tank | Capacity – 544.0$M^3$<br>MoC – RCC<br>Size – 17.0m x 10.0m x 3.2m TD<br>(0.2FB) | Capacity – 324.8$M^3$<br>MoC – RCC<br>Size – 14.5m x 7.0m x 3.2m TD<br>(0.2FB) |
| Primary Chamber / $1^0$Launder | Capacity – 23.0$M^3$<br>MoC – RCC<br>Size – 1.0m x 10.0m x 2.3m Ht.<br>(0.3FB) | Capacity – 23.0$M^3$<br>MoC – RCC<br>Size – 1.0m x 10.0m x 2.3m Ht.<br>(0.3FB) |
| Constructed Wetland Bed | Capacity – 1288.0$M^3$<br>MoC –RCC<br>Size – 56.0m x 10.0m x 2.3m Ht.<br>(0.3FB) | Capacity – 759.0$M^3$<br>MoC – RCC<br>Size – 33.0m x 10.0m x 2.3m Ht.<br>(0.3FB) |
| Intermediate Collection Tank | Capacity – 46.0$M^3$<br>MoC – RCC<br>Size – 2.0m x 10.0m x 2.3m Ht.<br>(0.3FB) | Capacity – 46.0$M^3$<br>MoC – RCC<br>Size – 2.0m x 10.0m x 2.3m Ht.<br>(0.3FB) |
| Final Collection Tank | Capacity – 46.0$M^3$<br>MoC – RCC<br>Size – 2.0m x 10.0m x 2.3m Ht. | Capacity – 46.0$M^3$<br>MoC – RCC<br>Size – 2.0m x 10.0m x 2.3m Ht. |

| Description | 375CMD x 1No. (20M³/Hr) | 220CMD x 1No. (12M³/Hr) |
|---|---|---|
| | (0.3FB) | (0.3FB) |
| Foundations | For all pumps, Carbon & Sand Filters and Panel | |
| Filling Media for CWT Beds & Filters<br>300 – 500mm<br>100 – 150 mm<br>25 – 40 mm | Different size and grades of stones and rocks<br>644.0M³<br>386.4M³<br>257.6M³ | Different size and grades of stones and rocks<br>379.5M³<br>227.7M³<br>151.8M³ |

| Description | 375CMD x 1No. (20M³/Hr) | 220CMD x 1No. (12M³/Hr) |
|---|---|---|
| **Mechanical Equipment** | | |
| Screens | Dimension – 1.0m x 1.2m<br>Spacing - 25mm & 10mm<br>Type – Bar<br>MoC – MS-EP | Dimension – 1.0m x 1.2m<br>Spacing - 25mm & 10mm<br>Type – Bar<br>MoC – MS-EP |
| | | |
| Effluent Lifting Pumps + Base Frame & Hardware (1W + 1S) | Capacity – 20.0M³/Hr @ 16 - 20m Head<br>Make –Kirloskar / Equiv.<br>Type – Submersible pump<br>HP – 3.0 – 4.0<br>MSEP Base Frame<br>Anchor Fastener for mounting<br>Rain Cap<br>Pressure Gauze –Feedig / Akai<br>UPVC Delivery line common for W + S pumps | Capacity – 12.0M³/Hr @ 16 - 20m Head<br>Make –Kirloskar / Equiv.<br>Type – Submersible pump<br>HP – 2.0 – 2.5<br>MSEP Base Frame<br>Anchor Fastener for mounting<br>Rain Cap<br>Pressure Gauze –Feedig / Akai<br>UPVC Delivery line x common for W + S pumps |
| | | |
| Pressure Sand Filter (1Nos.) | Capacity – 22.0m³/Hr | Capacity – 13.0m³/Hr |

| Description | 375CMD x 1No. (20$M^3$/Hr) | 220CMD x 1No. (12$M^3$/Hr) |
|---|---|---|
| | Make – Technogreen<br>Pressure – 3.5Kg/$cm^2$<br>Dimension – 1500mm Ø & 2000mm Ht. (Approx.)<br>Sampling port – 12mm<br>Pressure gauze – Feedig / Akai<br>Multiport Valve – 25mm Ø<br>MoC – MS-EP<br>Media I – 100mm, 50mm, 25mm, 1mm size sand | Make – Technogreen<br>Pressure – 3.5Kg/$cm^2$<br>Dimension – 1200mm Ø & 1800mm Ht. (Approx.)<br>Sampling port – 12mm<br>Pressure gauze – Feedig / Akai<br>Multiport Valve – 25mm Ø<br>MoC – MS-EP<br>Media I – 100mm, 50mm, 25mm, 1mm size sand |
| | | |
| Activated Carbon Filter (1Nos.) | Capacity – 22.0$m^3$/Hr<br>Make – Technogreen<br>Pressure – 3.5Kg/$cm^2$<br>Dimension – 1500mm Ø & 2000mm Ht.<br>(Approx.)Sampling port – 12mm<br>Pressure gauze – Feedig / Akai<br>Multiport Valve – 25mm Ø<br>MoC – MSEP<br>Media II – Activated carbon<br>I value – 900 | Capacity – 13.0$m^3$/Hr<br>Make – Technogreen<br>Pressure – 3.5Kg/$cm^2$<br>Dimension – 1200mm Ø & 1800mm Ht.<br>Sampling port – 12mm<br>Pressure gauze – Feedig / Akai<br>Multiport Valve – 25mm Ø<br>MoC – MSEP<br>Media II – Activated carbon<br>I value – 900 |
| | | |
| Filter Feed Pumps with level sensor + Base Frame & Hardware (1W + 1 S) | Capacity – 22.0$m^3$/Hr @ 36m Head<br>Make – Paint Air / Equiv.<br>MoC – CI<br>Type –Self Priming / Monoblock<br>HP – 4.0 – 5.0<br>MSEP Base Frame<br>Anchor Fastener for mounting | Capacity – 13.0$m^3$/Hr @ 36m Head<br>Make – Paint Air / Equiv.<br>MoC – CI<br>Type –Self Priming / Monoblock<br>HP – 2.5 – 3.5<br>MSEP Base Frame<br>Anchor Fastener for mounting |

| Description | 375CMD x 1No. (20$M^3$/Hr) | 220CMD x 1No. (12$M^3$/Hr) |
|---|---|---|
| | Rain Cap<br>Pressure Gauze –Feeding / Akai<br>MS Delivery line common for W + S pumps | Rain Cap<br>Pressure Gauze –Feeding / Akai<br>MS Delivery line common for W + S pumps |
| | | |
| UV Disinfection System | Flow Rate: 22.0$M^3$/Hr.<br>Make – Arklite / Alfa<br>SS 304/316 Shell, internally and externally mirror finished<br>Shell will have clamps for easy dismantling and cleaning.<br>Designed for requisite number of UV lamps<br>Necessary gaskets<br>Designed for double open end quartz tube with 95% UV transmittance.<br>Inlet and Outlet of size : as per flow rate<br>60mJ / sq. cm. For wastewater treatment<br>UV transmission in water is 85% | Flow Rate: 13.0$M^3$/Hr.<br>Make – Arklite / Alfa<br>SS 304/316 Shell, internally and externally mirror finished<br>Shell will have clamps for easy dismantling and cleaning.<br>Designed for requisite number of UV lamps.<br>Necessary gaskets<br>Designed for double open end quartz tube with 95% UV transmittance.<br>Inlet and Outlet of size : as per flow rate<br>60mJ / sq. cm. For wastewater treatment<br>UV transmission in water is 85% |
| | | |
| Flow Meters for Inlet/Outlet (2 Nos.) | Type – Electromagnetic<br>Make – Electronet<br>MoC – SS Teflon<br>Size – 1" – 2"Ø<br>Digital Display – 16mm * 2mm LCD, 4 digit for flow rate & 8 digit for totalizer<br>Process Pressure – 10$kg/cm^2$<br>Battery Limits – 1.0 – 10.0$m^3$/Hr<br>Vel. – 1 – 4m/s | Type – Electromagnetic<br>Make – Electronet<br>MoC – SS Teflon<br>Size – 1" – 1.5"Ø<br>Digital Display – 16mm * 2mm LCD, 4 digit for flow rate & 8 digit for totalizer<br>Process Pressure – 10$kg/cm^2$<br>Battery Limits – 1.0 – 10.0$m^3$/Hr<br>Vel. – 1 – 4m/s |

| Description | 375CMD x 1No. (20M³/Hr) | 220CMD x 1No. (12M³/Hr) |
|---|---|---|
| | Output – 4 – 20 mA | Output – 4 – 20 mA |
| | | |
| **Interconnecting Piping & Control Valves** | | |
| Unit Inter Connection | Size : ∅ 90/150 mm x 6kg/10kg UPVC | Size : ∅ 100/125 mm x 6kg/10kg UPVC |
| Pump Suctions & Discharge | Size : ∅ 40/60/90/120 mm x 6 kg<br>MoC: UPVC | Size : ∅ 25/40/75mm x 4kg<br>MoC: UPVC |
| From Collection tank | Size: Variable ranging from ∅90/12∩ mm x 4 kg/ 6 kg UPVC | Size: Variable ranging from ∅90/120 mm x 4 kg/ 6 kg UPVC |
| | | |
| Flow Control Valves | Estimated to be at least 17<br>MOC – UPVC | Estimated to be at least 17<br>MOC – UPVC |
| | | |
| **Electrical** | | |
| MCC Panel | Double Door MCC Panel<br>Make – Technogreen<br>DOL Starters – 5 Nos.<br>Main MCCB – 3p<br>Meter – Energy, Voltage, Ammeter<br>Single Phase Preventer<br>2 Nos. Control MCB<br>CT – Starlite, 50/5 with clamp<br>Indicator System – RYB + R Trip<br>Selector switch & Door switch Illumination<br>Panel Lock & Key | |

| Description | 375CMD x 1No. ($20M^3/Hr$) | 220CMD x 1No. ($12M^3/Hr$) |
|---|---|---|
| | Power & Control Terminals<br>PVC Gland, PVC Channel, TIN Rail channels, Lugs, Ferruls, cable tie, stick pad, Hardware, Rubber Gasket, acrylic sheet front door<br>Powder coated Panel box with canopy and mounting stand<br>Control wires – RYB, brown for earthing, grey for sensors | |

| Other Supply Items |
|---|
| Supply of plant species (stabilized in laboratory for 1 month) |
| Bio-media Culture as required at site for Phytorid technology treatment as approved by NEERI |