# Standard Operating Procedure (SOP)- NAAC

| | | | | |
|---|---|---|---|---|
| 74. | 7.1.4 ***Water conservation facilities available in the Institution:***<br><br>1. Rain water harvesting<br>2. Borewell /Open well recharge<br>3. Construction of tanks and bunds<br>4. Waste water recycling<br>5. Maintenance of water bodies and distribution system in the campus<br><br>**Options:**<br><br>A. Any 4 or all of the above<br>B. 3 of the above<br>C. 2 of the above<br>D.1of the above<br>E. None of the above | • Geo-tagged photographs of the facilities.<br>• Bills for the purchase of equipments for the facilities created under this metric.<br>• Any other relevant evidences for the selected options.<br>• Green audit reports on water conservation by recognised bodies | | |

# 7.1.4 Water Conservation facilities available in the Institution

**Initiatives of VFSTR**

**7.1.4**

**1. Rain water Harvesting:**

VFSTR is located at distance of 25 kms from Guntur, Andhra Pradesh (India).It lies between latitude 16° 14' 4" N and longitude 80° 33' 40.5" E. The population of VFSTR campus including staff and students are approximately 4000 on an average. Entire VFSTR campus contains 42.86 acres of land. It holds various types of buildings viz. A- Block, U-Block, Pharmacy, H-Block, Boys and Girls hostel, gym, library etc.

All the rainwater in each block is collected from roof top and this water is directed to rainwater harvesting pits situated at each block. The excess amount viz. water from roads, landscapes and other is directed to Open well recharge pit through open and closed drain distribution system.

The technical details of rain water harvesting potential will be dealt in the following sessions.

**(a) Rain water harvesting system at VFSTR:-**

**1. Catchment area**

Catchment area is the surface on which the rain water falls. In the campus, all the building's roofs are taken as catchment area. The total estimated area of building roofs/terraces is 15,832 Sq.m. as shown in Table 1.

**Rain water Harvesting potential from Terrace and roads of VFSTR:-**

Under water conservation facilitates available in the institution, Rain water harvesting pits at six locations are identified and are installed at suitable locations as shown in fig 1-6. The table1 shows the annual rain water harvested at each block every year. Coarse mesh / leaf screen is used to prevent the entry of leaves and other debris in the system. For every build of VFSTR, this facility is provided to stop the debris to enter into the Recharge pit.

Artificial recharge to ground water is a process by which the ground water reservoir is augmented at a rate exceeding that obtaining under natural conditions or replenishment. Any man-made scheme or facility that adds water to an aquifer may be considered to be an artificial recharge system. Based on the above factors, the water harvesting potential of site could be estimated using the following equation:-

**Rain Water harvesting potential = Amount of Rainfall * Area of catchment * Runoff coefficient**

Terrace Area = 15, 832 $m^2$
Annual water harvesting potential = **8130.816 ~8131 $m^3$**
= 81, 31,000 litres

| Table 1. Rain Water Harvested yearly | | | | | |
|---|---|---|---|---|---|
| **Block** | **Roof Area (sq. m) (1)** | **Annual Rainfall (m) (2)** | **(Evaporation, flushes)Losses (3)** | **Surface efficiency (4)** | **Annual Rain Harvesting (1)*(2)*(3)*(4) ($m^3$)** |
| **Bhuvanavijayam block** | 3012 | 0.95 | 0.8 | 0.6 | 1373.472 |
| **Visweswarayya Block** | 3670 | 0.95 | 0.8 | 0.6 | 1673.52 |
| **AryabhattaBlock** | 4045 | 0.95 | 0.8 | 0.6 | 1844.52 |
| **Vignan Vihar Boys Hostel** | 1123 | 0.95 | 0.8 | 0.6 | 512.088 |
| | 651 | 0.95 | 0.8 | 0.6 | 296.856 |
| **JC Bose Block** | 2331 | 0.95 | 0.8 | 0.6 | 1062.936 |
| **Priyadarshini Girls Hostel** | 3000 | 0.95 | 0.8 | 0.6 | 1368 |
| **Total** | 15, 832 | | | | **8130.816** |

Based on the harvesting potential, the design of recharge pit is arrived (fig.7) and is installed in various locations of VFSTR as shown below. In addition to that more than half of college is having a green landscape. These landscape acts as a natural rain water harvesting pits for ground water recharge**.**

# Location of Recharge pits sites

## U Block


Fig 1. Google map showing the location of PIT


Fig 2. Recharge pit at U-Block

# A Block


Fig 3. Google map showing the location of PIT at A-Block


Fig 4. Recharge pit at A-Block

# H Block


Fig 5. Google map showing the location of PIT at H-Block


Fig 6. Recharge pit at H-Block

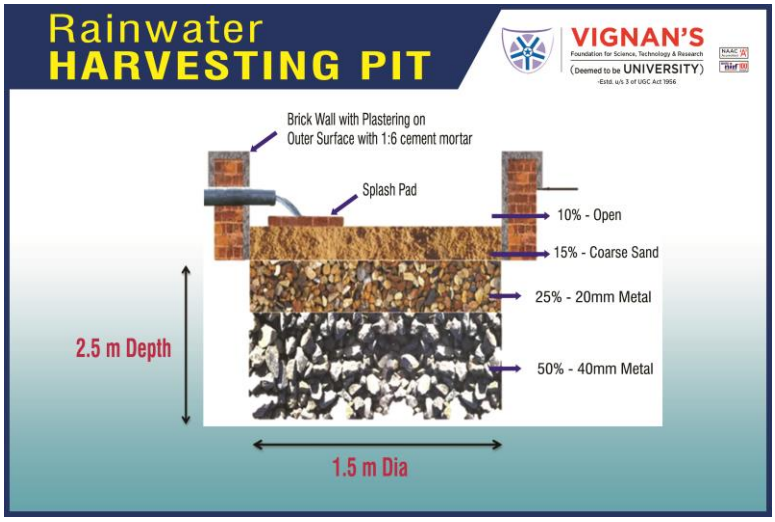


**Fig 7.**Design of Recharge Pit Implemented at VFSTR

## 2. Open Well Recharge

Figure 8 shows an open well recharge with bund protection where excess rainwater is collected from roof tops and through underground drains, roads and others (Open spaces, land scapings) through suitable drainage system. In every building the drainage system is in such a way that, all the rain water from roof of buildings is collected and is directed towards open well recharge pit/pond which is situated at lower elevation (Fig .9 &10) situated near Girls hostel, VFSTR . The capacity of the open recharge well is about 120 Lakh liters covering an area of 6020 $m^2$. The open recharge well at VFSTR increased the ground water level in nearby well and recharged the ground water aquifer.

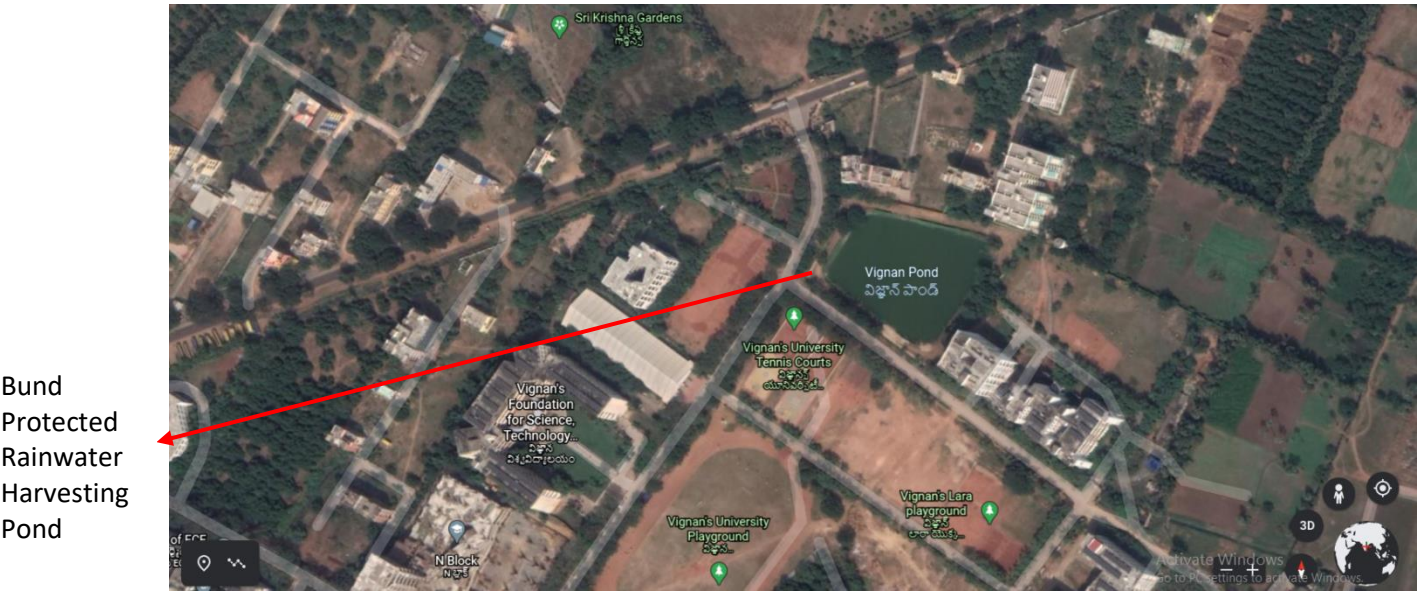


Fig 8. Open well recharge with bund protection

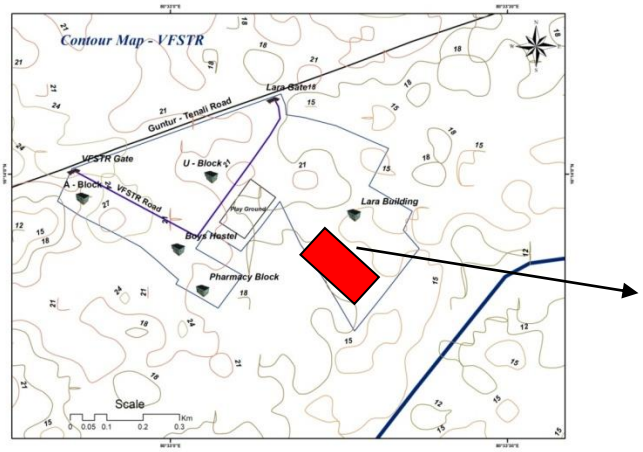


Figure 9: Contour or Elevation map of VFSTR showing Open well Recharge.


Drainage system (Outlet PVC pipe) discharging Rain water to Rain water harvesting pond

**(a)**


Bund Protection

(b)

Fig 10 (a&b).VFSTR campus having Open well Recharge **(GEO TAGGED PHOTOS)**

## 3. Constructions of Tanks and bunds

In VFSTR, every block is having water storage tank (Fig 11 &12) to cater the need of students and faculty. There are 16 tanks (2 Sumps are recently completed) and the total capacity of all tanks is shown in Table. 2. The total capacity of tanks is about 7.34 Lakh liters. Hence these tanks are sufficient to meet the Per Capita Consumption of all blocks which is about 5.5 Lakh Liters.

**Table: 2 Block Wise Per capita consumption and requirement**

| Sl No | Name of the Block | No. of tanks | Dimensions of Tank (m) L × B × H | Capacity of Tank (Litres) | Per Capita Consumption of each block (Litres) | No of times Refilling required | Maintenance in a week |
|---|---|---|---|---|---|---|---|
| 1 | **Aryabhatta block** | 2 | 4.20 × 3.90 × 1.6 | 26000 | 84330 | 1 | 1 |
| | | | 4.10 × 3.80 × 1.52 | 23500 | | | |
| | | | **Total** | **49500** | | | |
| 2 | **Visweswarayya Block** | 1 | 4.1 × 4.1 × 2.3 | 38500 | 81810 | 1 | 1 |
| | | | **Total** | **38500** | | | |
| 3 | **BhuvanaVijayam** | 1 | 14.20 × 4.60 × 2.0 | 130000 | 77670 | 1 | 1 |
| | | | **Total** | **130000** | | | |
| 4 | **Vignan Vihar Boys Hostel** | Wing1 **2** | 4.55 × 2.30 × 1.2 | 12500 | 139590 | 1 | 1 |
| | | | 8.15 × 3.50 × 2 | 57000 | | | |
| | | Wing2 **3** | 4.8 × 2.7 × 1.4 | 18000 | | | |
| | | | 6.7 × 3.55 × 1.4 | 33000 | | | |
| | | | 8.15 × 3.6 × 2.0 | 58000 | | | |
| | | | | | | | |
| | | 2 | 4.40 × 10.50 × 2 | 92000 | | | 1 |
| | | | 3.60 × 4.70 × 1.7 | 28500 | | | |
| | | | **Total** | **199000** | | | |
| 6 | **Priyadarshini Girls Hostel** | 3 | 5.25 × 4.0 × 1.7 | 35000 | 143100 | 1 | 1 |
| | | | 4.70 × 5.3 × 1.7 | 24000 | | | |
| | | | 8.60 × 3.9 × 2.15 | 72000 | | | |
| | | | **Total** | **131000** | | | |
| 7 | **Guest House** | 1 | 4.90 × 2.34 × 2.5 | 28500 | 2700 | NA | 1 |
| 8 | **NTR Library** | 1 | 4.10 × 4.10 × 5.0 | 86000 | 22500 | NA | 1 |
| | | | **Total** | **86000** | | | |
| **Total LPCD** | | | | **734000** | **551700** | | |


Fig 11. **38,500 Litres** capacity tank at H-Block, VFSTR


Fig 12. **58K Litres** capacity tank at Vignan Vihar Boys Hostel

## 4. Waste Water Recycling

The quantity of water utilized in the each block is shown in the table 2 and to treat this waste water, an innovative green technology "constructed wetland system" has been used. Based on this technology, the STP is established in the campus in association with Blue Drop Enviro Consultant Company, Hyderabad as in fig 13,14 &15. The plant is established at lower elevated site in the campus. The proposed plan of Constructed wetland system is shown in the fig 10 and 11 below. Total amount of waste water going to be recycled is 600 KLD. The total budget spent on this facility is **Rs: 98,91,360/-** (Civil Work :Rs 58,64,840 and Electro mechanical Equipments =40, 26, 520). The design details are mentioned below.

**Design Aspect:**

The main components of Constructed Wetland Sewage Treatment Systems are:

1) Pre-Treatment – Bar Screening.
2) Primary Treatment - Holding tank - Up to 1 day retention volume.
3) Secondary Treatment – Aerated Wetland Cells
4) Tertiary Treatment – Ozonation (Proposed).

**Technology adaptation for Wetlands**

1) **Bio-Passive Wetlands**: Passive wetland application is one where the area needed for wetland cells is equal to or more than 4 sq mtr per kl of treatment and microbial dosing is done in parallel.

2) **Bio-Aerated Wetlands:** Aerated wetland application is one where aeration is introduced in the wetland cells with external blowers and the area needed for a wetland cell is approximately 1 sq mtr per KL of treatment and microbial dosing is done in parallel. Aeration is introduced in the wetland cells with external blowers. The maximum runtime of the blowers being 4 to 6 hrs per day at peak load.

**We have proposed a Bio-Aerated Wetland for your premises.**

**Tertiary Treatment**

The above mentioned arrangements together with an Ozonator provide treated water for non-contact purpose like gardening/agriculture and flushing. If the treated water is to be used for purpose like Vehicle washing and water cooled air conditioning then, further polishing is recommended.

## WASTE WATER RECYCLING

## Establishment Of Decentralized 600 KLD Sewage Treatment System At Vignan's Foundation For Science Technology and Research, Guntur.

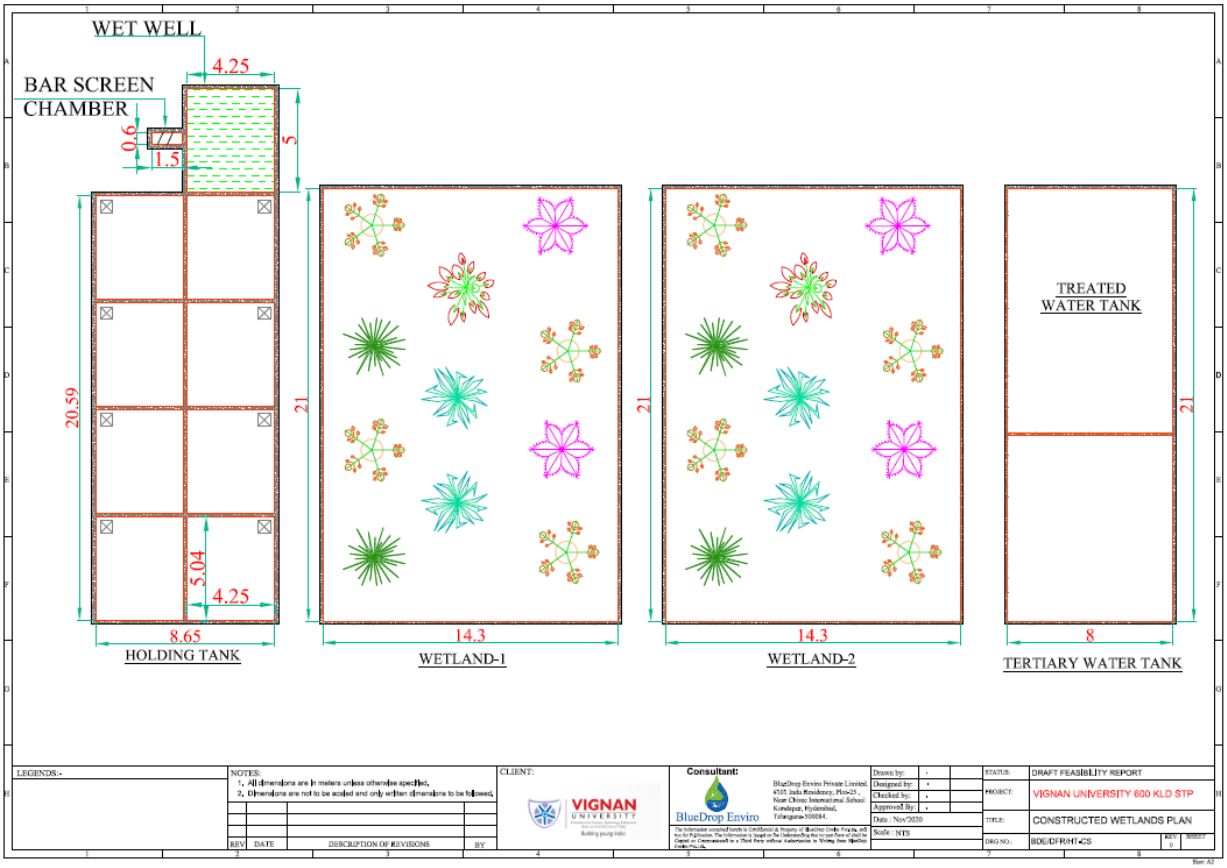


Fig 13. Plan of STP-Constructed Wetland Technology

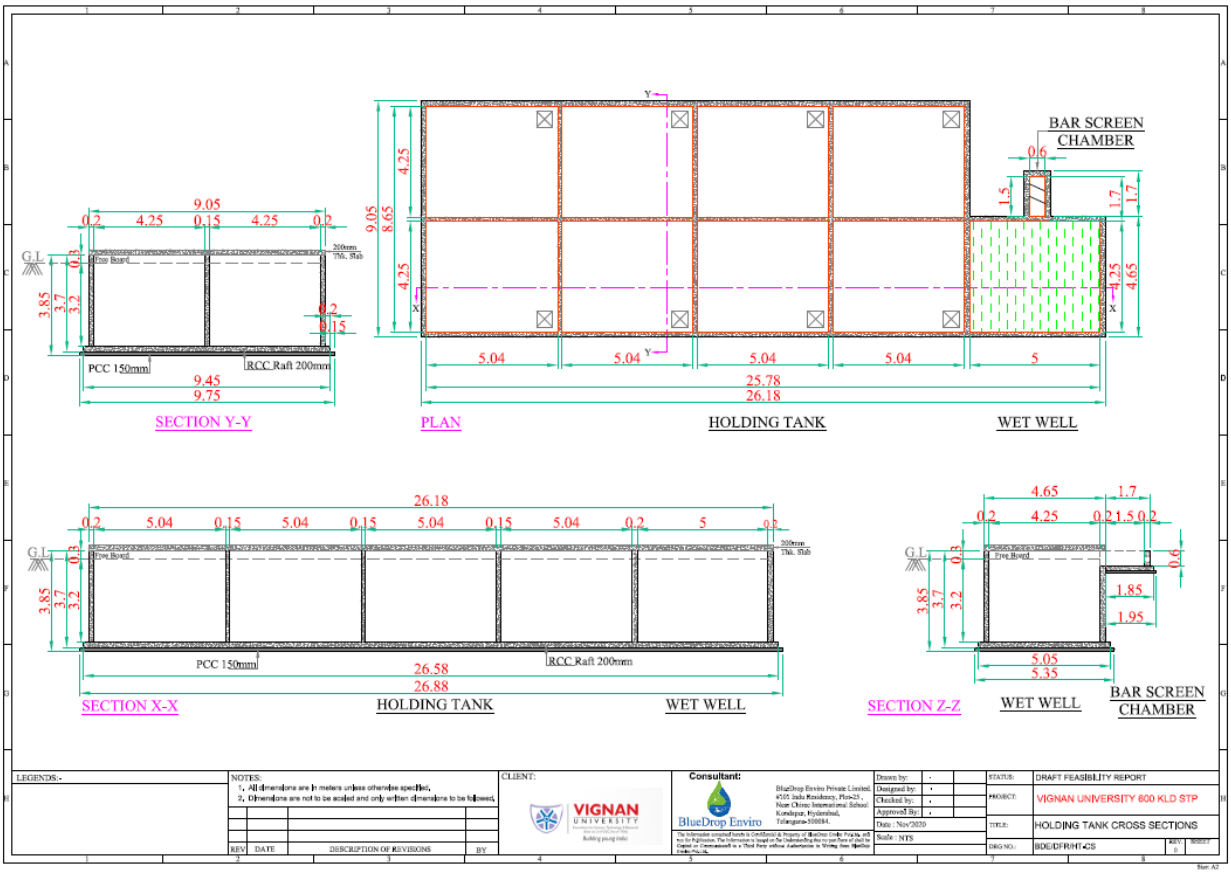


Fig 14 Plan of Constructed Wetland-With Dimensions

**Image Gallery:**

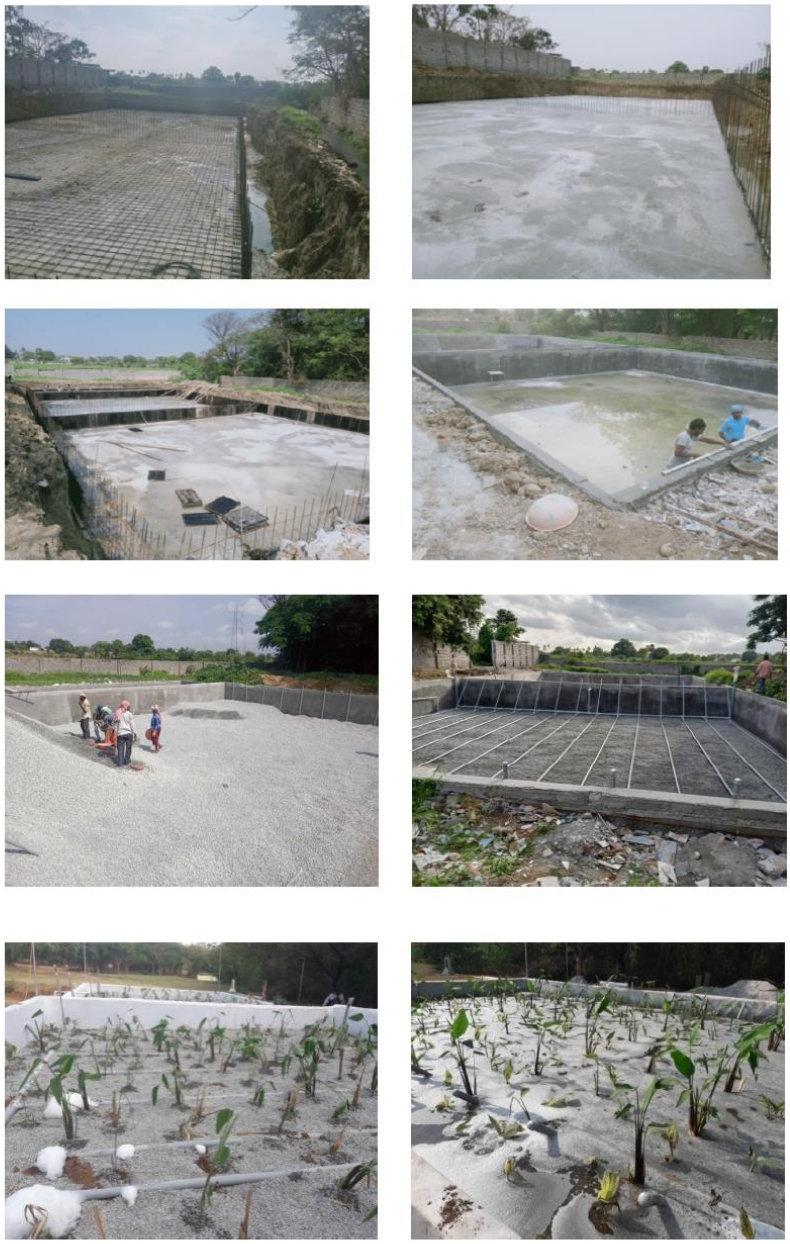

Fig 15 Execution of STP at VFSTR-Constructed Wetland

## 5. Maintenance of Water Bodies and Distribution systems

The conduits used in VFSTR building are of type viz., cement asbestos, PVC, GI or cast iron as shown in Fig 16-18. All the over flowed rain water from roof tops enters into the drainage system to rain water harvesting pond will undergo initial screening process, where all the dirt, leaves, stones other materials will be collected at the screen bars to prevent bad smell, silting and eutrophication.

For efficient operation and maintenance of distribution system, the following activities are undertaken by VFSTR technicians.

- Preventive Maintenance, this is the regular activity carried out to prevent breakdowns and to ensure that assets fulfil its service life.
- Preventive maintenance includes servicing of equipment and distribution system, inspecting wear and tear replacing with necessary parts.
- It is the daily task, which includes checking water levels, eutrophication areas, floating materials, Inspecting inlet pumps, motors and controls, maintaining a registrar.
- Annual task includes flushing the distribution system and checking all the fire hydrant valves. Corrective maintenance is carried out when a part of system is fulfilled its service life, replacing it with necessary new parts.
- To reduce the harmful bacterial activities chlorine tabs has been used.


Fig 16. Distribution system at VFSTR campus


Fig 17. Open Drains at VFSTR campus


Fig 18. Closed Drain system at VFSTR campus

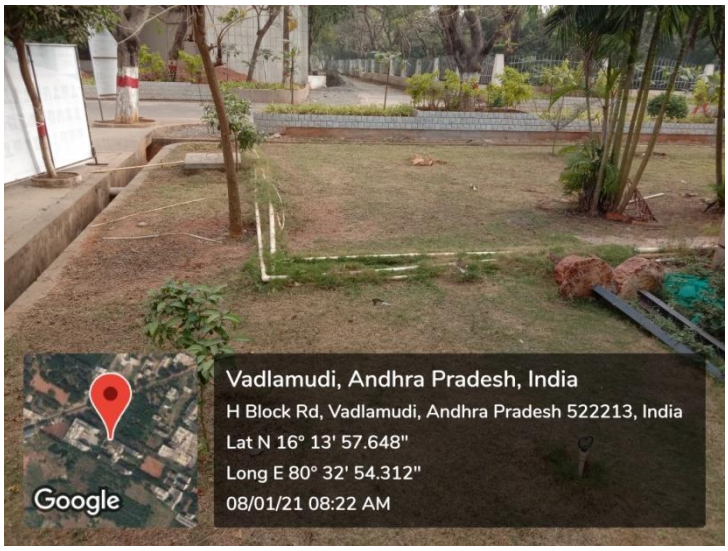


Fig 19. Sprinkler irrigation system at an open space