UWR Rainwater Offset Unit Standard

(UWR RoU Standard)

Concept & Design: Universal Water Registry

www.uwaterregistry.io

Project Concept Note & Monitoring Report

(PCNMR)

Project Name: Wastewater Treatment Project by Tirupur Murugampalayam CETCPL

UWR RoU Scope:5
Monitoring Period: 01/01/2014-31/12/2023
Crediting Period: 2014-2023
UNDP Human Development Indicator:0.66(India)
RoUs Generated During 1st Monitoring Period :5,949,077

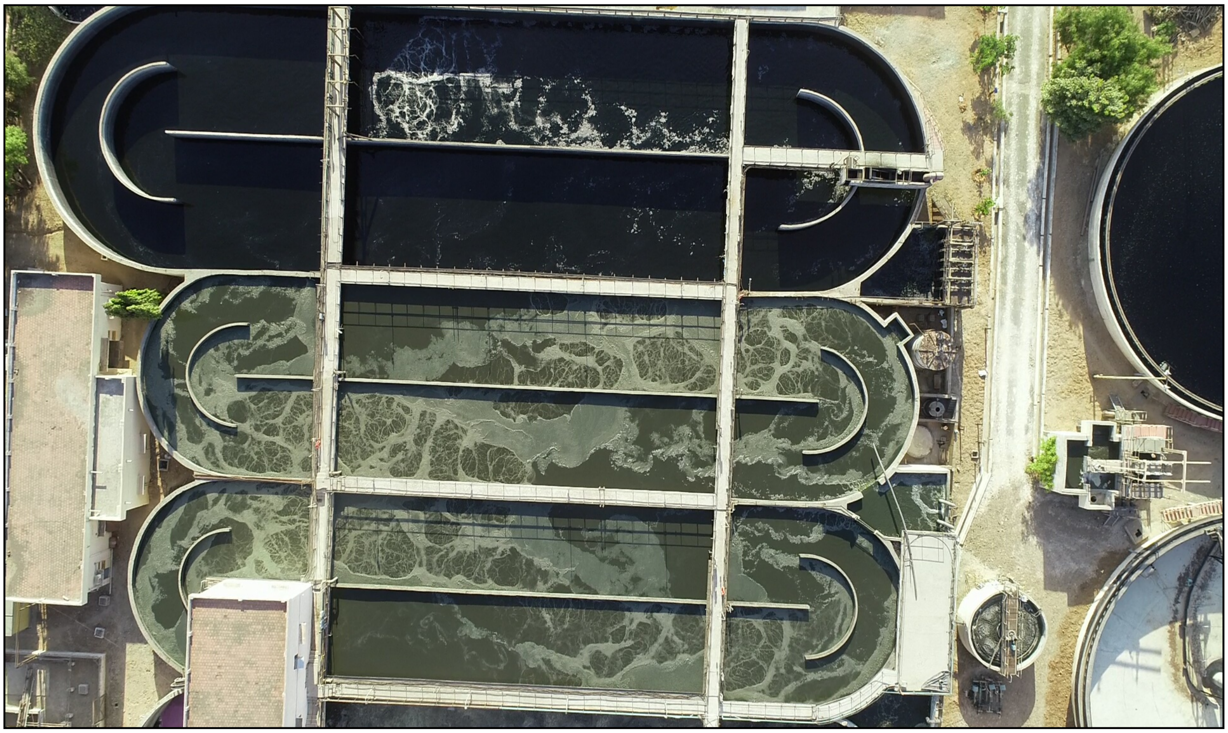
A.1 Location of Project Activity

State	Tamil Nadu
District	Tiruppur
Block Basin/Sub Basin/Watershed	http://cgwb.gov.in/watershed/basinsindia.html Noyyal River
Lat. & Longitude	11°04'28"N 77°19'41"E
Area Extent	SF. NO – 214/2, Erankattu Thottam, Murugampalayam, Iduvamplayam (PO) Tirupur – 641687, Tamil Nadu, India.
No. of Villages/Towns	Murugampalayam Village

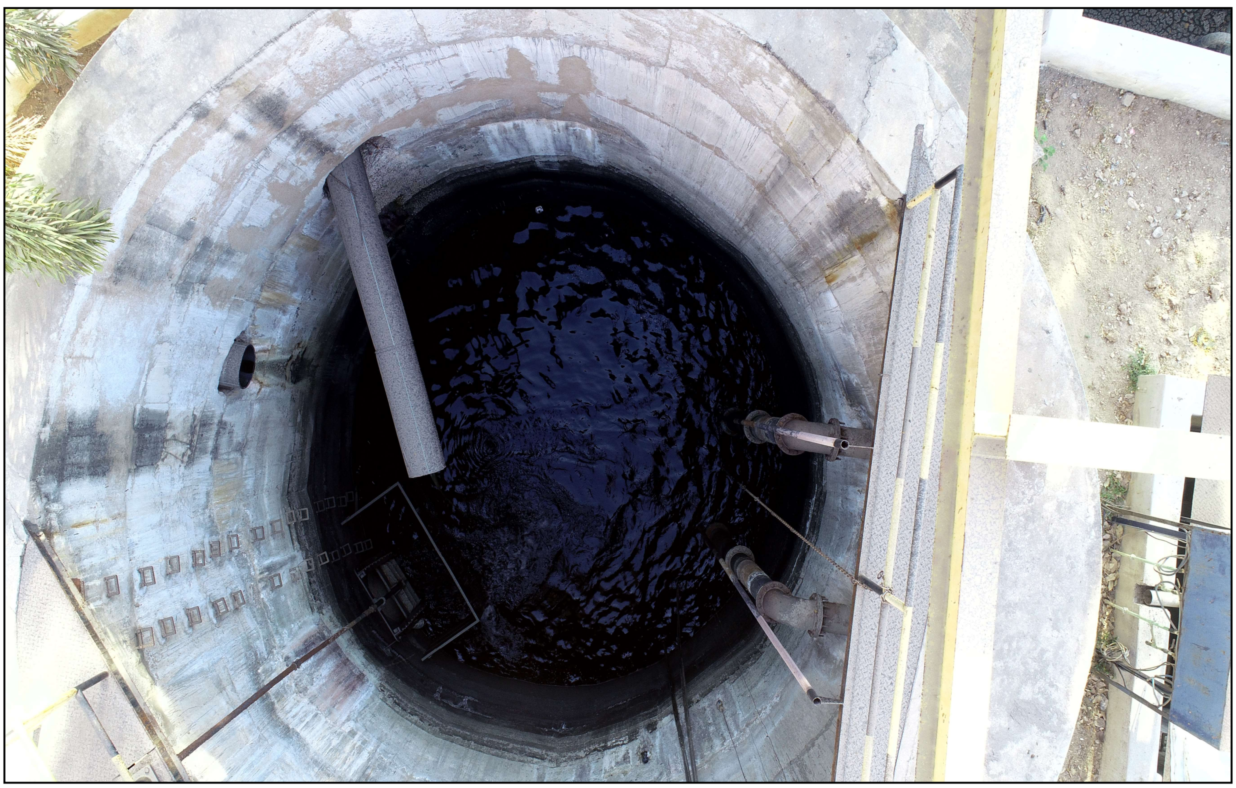
Bird-view of Tirupur Murugampalayam CETCPL

Clarifier

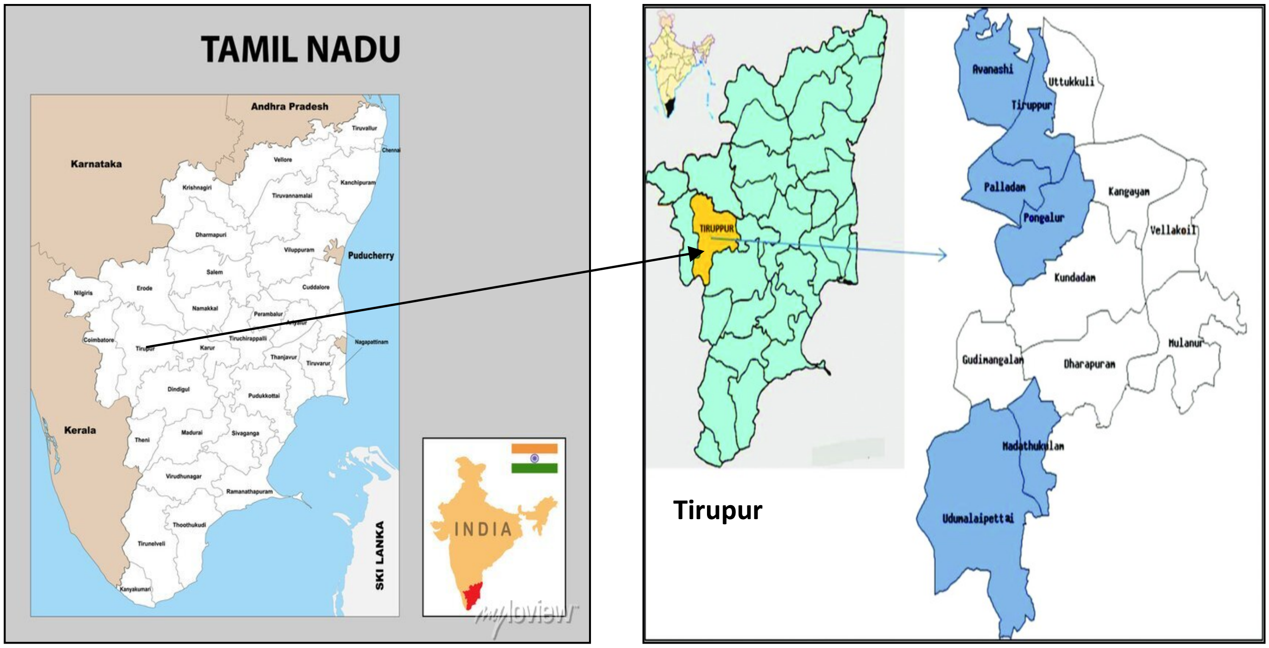
Pressure Pump



Aeration Tank



Inlet collection well for CETP from member units



A.2. Project owner information, key roles and responsibilities

Project Proponent (PP):	TIRUPUR MURUGAMPALAYAM COMMON EFFLUENTS TREATMENT COMPANY PVT LTD
UCR Project Aggregator	Viviid Emissions Reductions Universal Private Limited
Contact Information:	lokesh.jain@viviidgreen.com

The Tirupur Murugapalayam Common Effluent Treatment Plant (CETP) is situated in Murugampalayam, Iduvampalayam, Tamil Nadu. Designed with a capacity of 11 MLD, it currently processes 10.9 MLD of wastewater from 50 dyeing units in the region. This facility plays a crucial role in managing the environmental impact of the textile industry and conserving water resources.

The Project Proponent (PP) affirms that they meet all the requirements outlined in the management plan regarding ownership, legal rights, permits, and cost details for the successful implementation of the project. Specifically.

Water User Rights: The PP holds the necessary water user rights for the area within the project's boundary. These rights are legally secured and ensure that the PP has full entitlement to use the water resources required for the project's operations.

Legal Land Title: The PP holds an uncontested legal land title for the entire project area within the project's boundary. The title is fully documented and free of any disputes, confirming the PP's legal right to utilize the land for project purposes.

Necessary Permits: The PP has obtained all the required permits for the implementation of the project. In cases where certain permits are pending, the PP has already applied for the necessary approvals and is working in full compliance with the relevant regulatory requirements to ensure the timely commencement of the project.

Cost Details: The PP has thoroughly assessed and documented the cost details for project implementation. A detailed cost breakdown is available in the DPR, Capital Cost of project was RS. 69.94 Crores. covering all aspects of project development, including infrastructure, permits, equipment, and operational costs.

By meeting these criteria, the PP ensures that all legal and regulatory requirements for the project are satisfied, enabling the project to proceed without hindrance.

A.2.1 Project RoU Scope

PROJECT NAME	Waste Water Treatment Project by Tirupur Murugampalayam CETCPL.
UWR Scope:	Scope 5: Conservation measures taken to recycle and/or reuse water, spent wash, wastewater etc. across or within specific industrial processes and systems, including wastewater recycled/ reused in a different process, but within the same site or location of the project activity. Recycled wastewater used in off-site landscaping, gardening or tree plantations/forests activity are also eligible under this Scope.
Date PCNMR Prepared	06-12-2024

A.3. Land use and Drainage Pattern

Not Applicable.

This project activity involves treating and reusing wastewater. It doesn't include any land-use practices. Also, this is an industrial process designed with technical requirements and following the specified norms of the local pollution control board. Hence, the project activity does not harm any land and Drainage system**.**

A.4. Climate

The project activity does not rely on the climatic conditions of the area as it treats and reuses only the wastewater from the dying & textile without letting the water be exposed to any climatic condition.

A.5. Rainfall

The project activity is not dependent on the rainfall pattern of the area as it treats and reuses the wastewater from the dying Industry.

A.6. Ground Water

NA

A.7. Alternate methods

TDS in effluent is treated in developed countries and in some other developing countries by adopting either of the two options:

(1) to combine it with domestic sewerage where it gets diluted for further treatment, or

(2) to discharge the high TDS treated effluent into the sea (marine discharge)

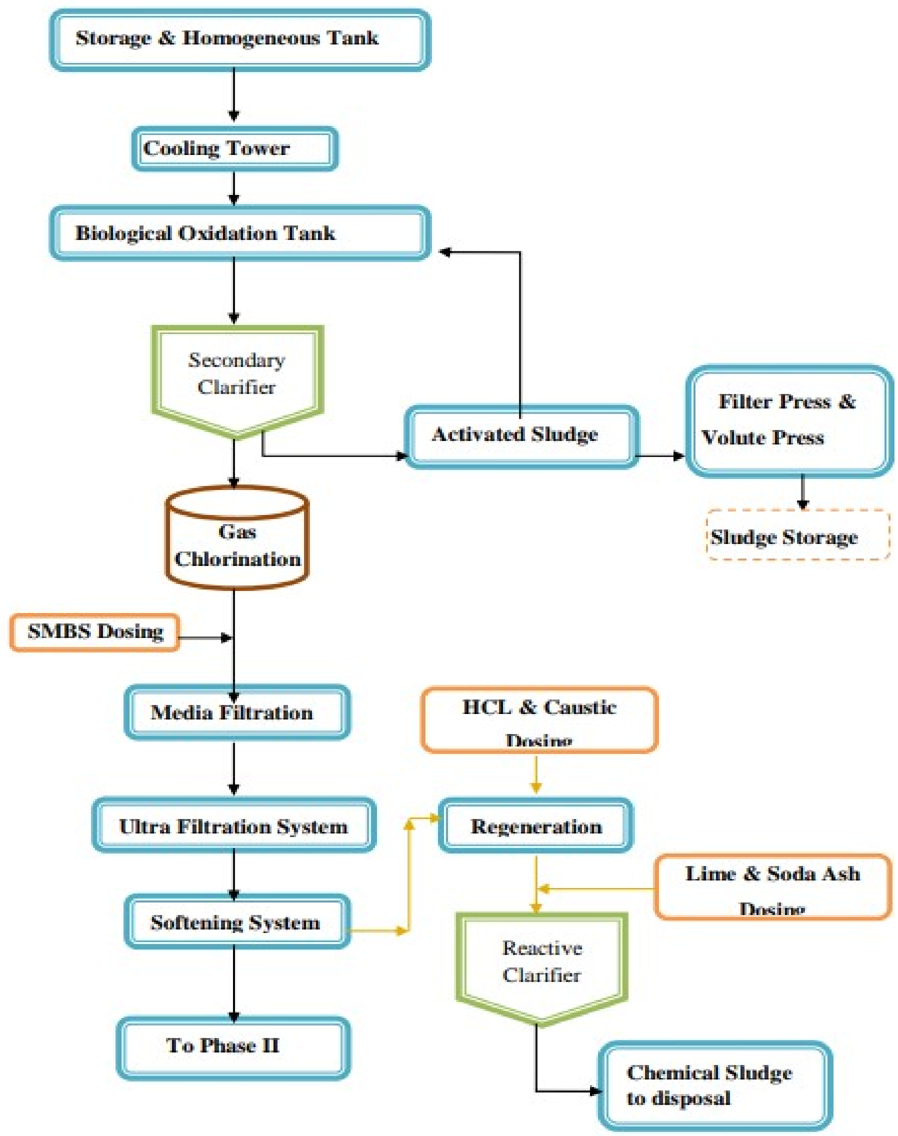
Unfortunately, neither of these options is readily available for the CETP. In the first instance, the domestic sewerage from the areas where factories are concentrated is not at all treated.

Secondly, the marine discharge option is impractical for Tirupur district, as the nearest seacoast is at least 600 km away. Consequently, the treated effluent is discharged into irrigation and factory premises. Although the Noyyal River is within the limits of Tirupur, the PP has not been given the option to either dilute its effluent with city sewerage or use marine discharge. Therefore, surface discharge of treated effluent is the method currently employed.

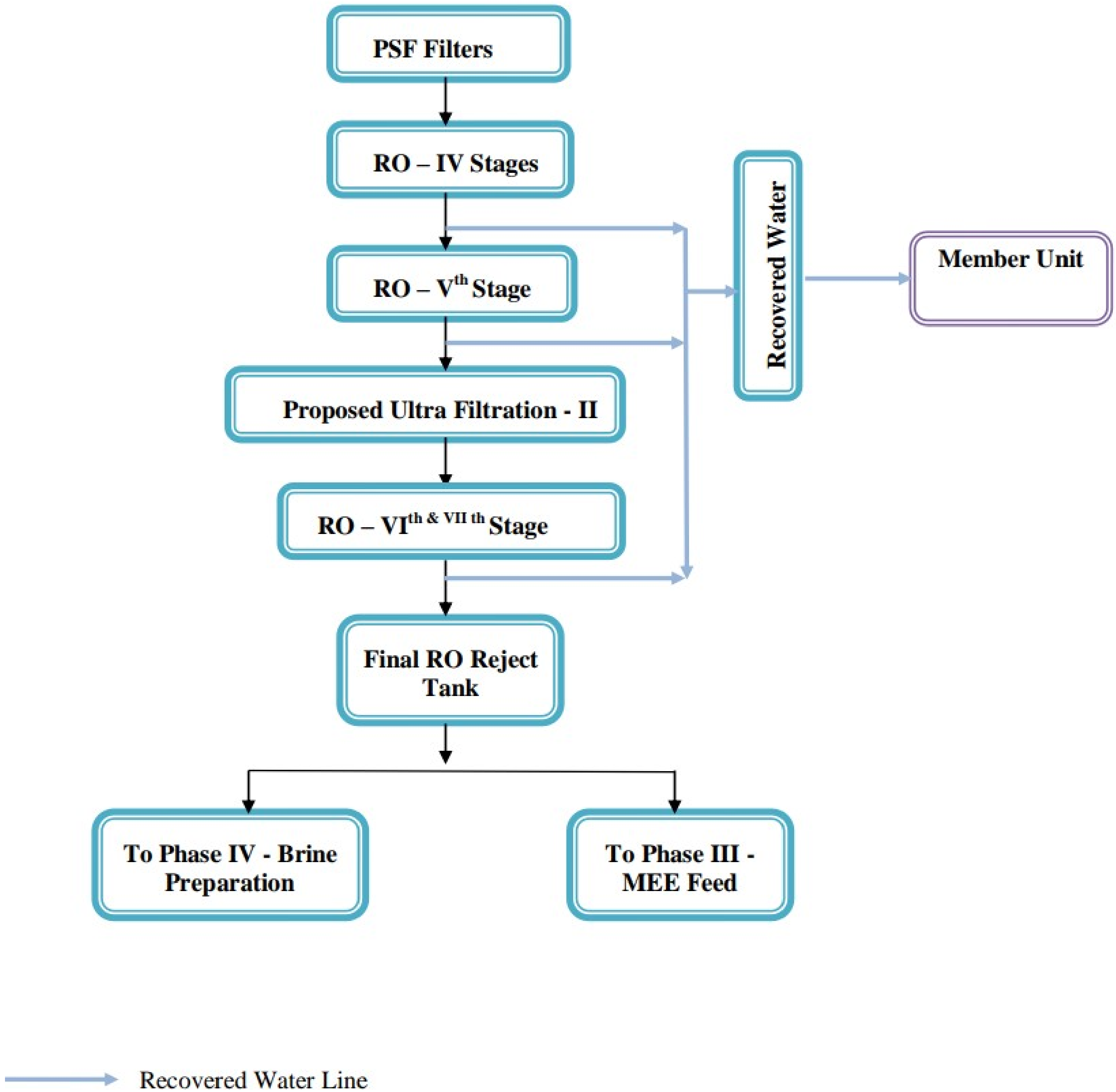
The RoU program promotes wastewater treatment and reuse initiatives, thereby offering an alternative to the release of wastewater through surface Discharge which could have an adverse impact on soil Health.

A.8. Design Specifications

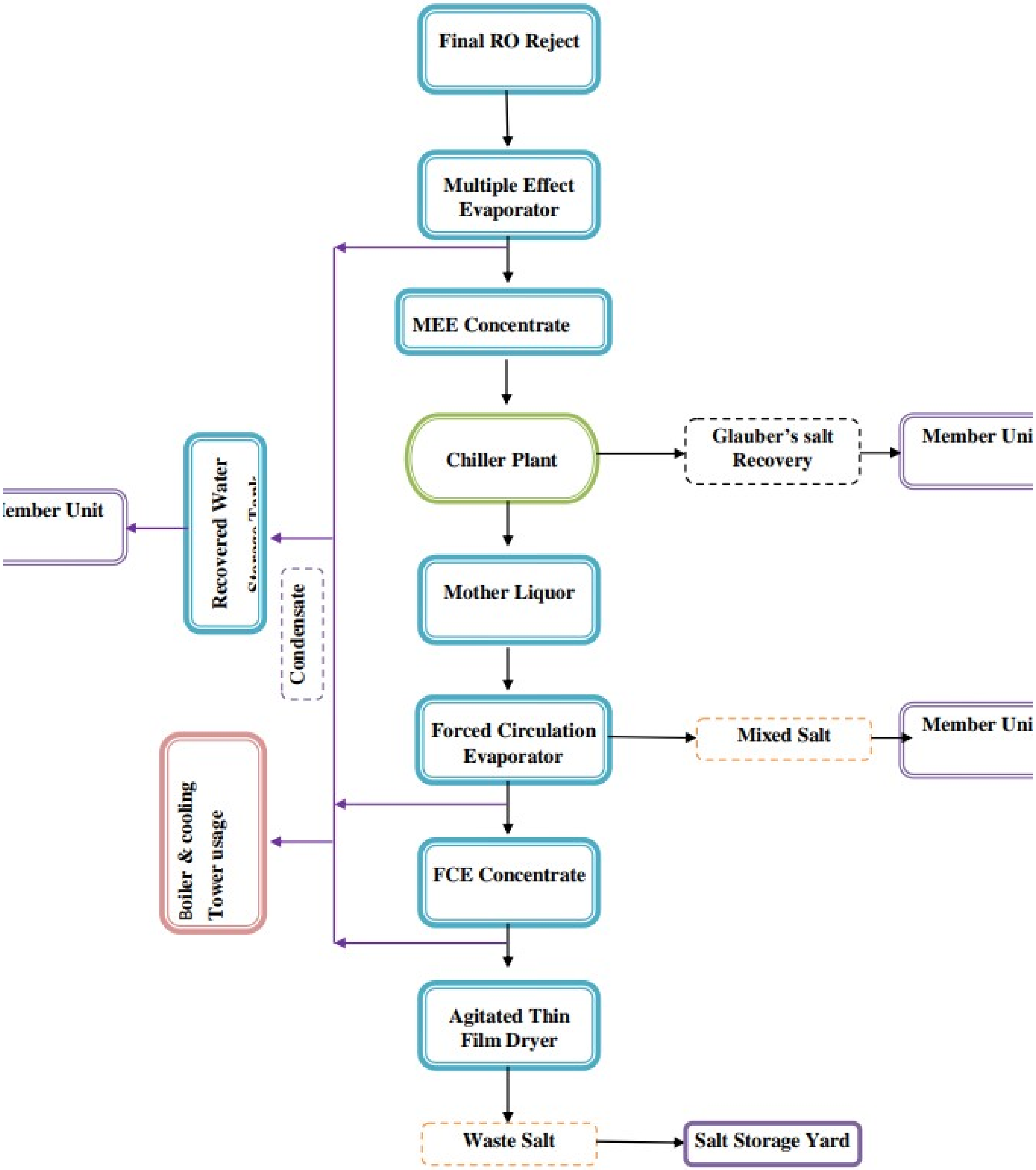
Pre-Treatment Phase -I



Reverse Osmosis – Phase –II



Reject Management System–III



Tirupur is an industrial town located about 450 kms Southwest of the city of Chennai, Tamil Nadu State. Tirupur is famous as one of the top knitwear exports centers of India. There are about 700 plus dyeing & bleaching units in and around Tirupur who are engaged in the dyeing and bleaching operations of the yarn & fabric. Currently 53 dyeing industries are under this CETP. These units generate effluents, which are currently being subjected to primary treatment, RO, MEE, ZLD and reused in the dyeing process to respective member unit.

The Tamil Nadu Pollution Control Board (TNPCB) has laid down specifications for the discharge of treated effluents into inland surface waters. One of the stipulations is that the TDS level has to be maintained below 2100 ppm in the discharge after treatment apart from the stipulations for other parameters. The TDS of the effluents discharged presently is higher than this limit. Therefore as a measure of pollution abatement the TNPCB has now mandated the industries to implement zero discharge facilities so that the pollution from the dyeing & bleaching units can be contained once and for all. Six new CETP's namely, Arulpuram, Rayapuram, Kallikadu, Murugampalayam Rayapuram, Mangalam and Eastern have joined together to form a Special Purpose Vehicles to implement the zero discharge facility. The SPV's are Noyyal Common Effluent Treatment Company Limited and Mangalam-Eastern Water Recycling Company Limited. The six CETP's, have mandated the Tamilnadu Water Investment Company Limited, Chennai (TWICL) for the implementation of the zero discharge facilities.

Treatment Process

a. Collection and conveyance of raw effluent and recovered water

b. Pretreatment

c. Reverse Osmosis (RO)

d. Evaporation

Pretreatment of the effluent for the reduction of BOD, COD, suspended solids and colour, Reverse Osmosis (RO) desalination of the pretreated effluent for the reduction of TDS and evaporation of the rejects in thermal process evaporators to recover the water as condensate and crystallize the salt.

The raw effluent will be received in the intake well via screen to remove fibers and trash from where it will be pumped into an equalization tank to homogenize the flow. From the equalization tank the effluent will be pumped into an aeration tank where the effluent is aerated using a system of diffusers and blowers for the reduction of BOD, COD and color. The effluent after aeration is settled in secondary clarifier for the settlement of the suspended solids and bio mass. A portion of underflow of the clarifier is recirculated into the aeration tank for maintaining the required level of MLSS. The remaining portion of underflow of the clarifier is further thickened in gravity thickener. The thickened sludge is dewatered in filter press where the biosludge is dewatered to about 30% consistency.

The over flow from the clarifier with about 50 – 60% reduction in colour is taken to a battery of quartz filters for the filtration of the suspended solids. The filtrate from the quartz filters is pumped into the resin filters where the balance colour is adsorbed rendering a colourless effluent. The filtrate from the resin filters is softened through ion exchange resin.

The softened effluent is pressurized into two stage RO blocks for the reduction of TDS. The rejects from the RO Block 1 is further desalinated in RO Block 2 to achieve an overall recovery of about 80-85%.

The rejects from the RO Block 2 is processed in multiple effect thermal process evaporators to recover the water in the rejects as condensate and crystallize the salt. About 85 to 90% recovery is achieved in the evaporation process.

The following treatment steps are envisaged in the pre-treatment section:

- a. Biological treatment
- b. Quartz filtration
- c. Resin filtration
- d. Softening filtration

Biological treatment

The biological treatment plant proposed is a typical "total oxidation activated sludge plant". This process has been very widely and successfully implemented in medium and large scale textile wastewater treatment plants all over the world including a 300 MLD plant in China. This technology is widely practiced in Italy, Spain, Mexico, Brazil, Bangladesh and Honduras where large number of textile wastewater treatment plants have been designed and operated successfully for more than a two decades.

The important features of the process are:

- Achievement of substantial, actual results in terms of drastic reduction of organic and inorganic pollution,
- Partial or total decoloration,
- Minimization of sludge volume,
- Minimization of running costs,
- Minimization of maintenance requirement,
- Reliability and flexibility of the proposed system.

The biological process consists of two interconnected lines:

- The water (effluent) line and,
- The sludge line.

A. The water line section consists of the following:

- Screening unit
- Storage and homogenising
- Neutralisation

- Biological oxidation
- Sedimentation

Screening unit

It has the goal to separate coarse and medium-fine solids at the inlet of the plant, avoiding thus their sedimentation in the next stages and clogging in the machinery (pumps, mixers etc.).

The solids are separated from the raw effluent by rotary brush screen. The cleaning of the screening surface is automatic and continuous and occurs by brushes, combs or counter current pressured water jets. The screening equipment is controlled by pre-set time switches or level sensors.

The debris collected from the screening unit is collected into a trolley with hopper facility and is removed periodically to be disposed of as municipal waste along with other housekeeping waste materials.

Storage and homogenisation

In order to feed the following aeration tank with an homogeneous flow and an uniform pollutants load, as well as to make bacteria acclimatise, the raw effluent is stored in a tank where it is mixed and lightly aerated. In this way the whole water volume is kept in movement and neither sedimentation and "dead zones", nor any anaerobic fermentation occur.

Mixing and aeration are performed by submersible mixers and submersible ejector pumps respectively. The aeration avoids fouling smell and it is a kind of pre-oxygenation, preparing the bacteria for the following stage.

The most important aspect of equalisation tank is to provide uniformity of the raw effluent which will feed the oxidation tanks with homogenized effluent, which will enable efficient performance of the biological system.

The parameters which are of paramount importance for efficient operation of the biological system are explained as follows:

pH: Generally, the textile industries wastewater has a pH between 3-5 (wool) and 11-13 (cotton). It is well known that the bacteria can work properly in a rage of pH between 7-8/8.5. Therefore, the pH correction with acid and soda is mandatory, in order to ensure a constant pH effluent. An automatic dosing system, controlled by a pH meter, guarantees a correct pH value.

Flow: The industrial discharges are not constant over the day; sometimes there is an excessive flow and sometimes there is no flow at all. This creates hydraulic problems; for example, in the clarifier, and organic load constancy in the biological tank. Moreover, the builder is forced to install powerful pumps that are used only for short periods. An equalisation tank is the most important aspect of biological system to provide uniformity of the raw effluent which will feed the oxidation tanks with homogenized effluent, which will enable efficient performance of the biological system.

Temperature: The optimum temperature range for the efficient operation of the biological system is 20-35°C. In order to maintain the temperature of the biological system, the effluent from the equalisation tank is heated by mixing with the effluent from the clarifier.

Salinity (TDS):

This parameter has wide variations over the day. This can create huge imbalances to the bacteria, which has a significant impact on the cellular membrane, which is forced to adapt to continuous porosity changes in order to survive. All this limits the bacterial efficiency and thus the outlet parameters quality is compromised. Also in this case, an accumulation tank helps keeping a constant TDS concentration that enters the biological oxidation. The temperature must remain constant as well.

Temperature:

The textile discharges can reach 70-80°C peaks, followed by discharges at 20-25°C. This can significantly affect the bacterial activity. An accumulation and homogenization tank is able to limit and counter the effects of the temperature peaks, even if it is not able to ensure the optimal temperature. [1] If the temperature in the accumulation tank is higher than 38°C, then it is necessary to install cooling towers in order to lower the inlet temperature. The mesophilic bacteria that develop between 4 and 42°C have an optimal metabolization rate between 24 and 38°C. Over 38°C, there is a significant decrease of their metabolism, or [2] reaction rate. The sludge flakes break down, creating a sludge that goes out of the clarifier, causing a high turbidity; the COD removal rate decreases and thus the outlet water has an unsatisfactory quality. The oxygen transfer rate decreases as well; between 32 and 42°C the rate halves, making it necessary to supply much more water. At this point, we have low efficiency, high outlet COD and high BODs concentration and suspended solids; the aeration costs increase exponentially.

In case the effluent temperature does not drop to required level, a provision has been made to install a cooling tower without affecting the plant operation.

COD BOD: (Chemical Oxygen Demand and Biological Oxygen Demand)

As the other parameters, such as TDS, residence time, etc. COD & BOD have important variations during the day. This created a concentration gradient in the biological oxidation tank, forcing the bacteria to change constantly. Once again, the system adapts but the efficiency decreases. Also in this case, a proper homogenization tank solves the problem.

Solids, fibers and other exogenous bodies:

The industrial discharges contain several solids that, if not properly separated, can foul pumps and valves during the depuration process phases. Parts of the tissues, thread, plastic parts and other types of matter are present, and their removal is obtained through an automated mechanical screening that divides solids whose dimensions are less than 1-2mm. We have analyzed the main external parameters and how they can cause several problems when not controlled and stabilized.

c) Neutralisation

Neutralisation step is required because of the wide pH range in the raw effluent. The biological oxidation needs a neutral or slightly alkaline pH value. Neutralisation is carried out automatically with soda or acid, depending on the characteristics of the raw effluent, by dosing pumps and it is controlled by a pH meter equipped with alarm signal.

The pumps supplied the reagents from storage tanks of a suitable capacity so as to maintain a pH value of 7-8. The start of the pump is automatic. The pH measurement is carried out by a glass made probe, equipped with potentiometer.

d) Biological oxidation

Basically it is a modified version of extended aeration activated sludge process, in which organic and inorganic suspended solids and part of the dissolved solids under go the oxidation by aerating the effluent in the aeration tank. The principle is based on the utilisation of aerobic bacteria colonies naturally present in raw effluent which have three fundamental characteristics:

- They accomplish their vital cycle metabolising the organic matter
- They reproduce increasing quickly.
- They tend to live in and to form colonies

To assimilate and to transform organic matter, the bacteria need oxygen as support of combustion. The final products of this process are [1] H_2O, CO_2 and new living substance. The oxygen source will be partly of that existing in the effluent and remaining is supplied from outside. The oxygen as feed causes a very fast multiplication of the bacteria, they get together in colonies and aggregate in "flocs". In these flocs protoplasm cells, coming from organic synthesis, organic metabolised solids and residual organic matter of vital bacteria cycle, are concentrated. Moreover, organic and part of inorganic non separable solids adhere to the flocs by adsorption.

Sludge flocs have two characteristics:

- settle by gravity
- have high concentration of active organic matter

The homogenized effluent is fed with air through an aeration system consisting of fine bubble membrane disc diffusers, with relevant headers, manifolds and accessories, placed on the bottom of the tank and producing fine bubbles and air compressor station.

An oxygen meter is provided for the monitoring of the O_2 concentration in the water.

e) Sedimentation

The aeration tank outlet, which contains mixed liquor suspended solids of 5000 to 5500 mg/l, enters secondary clarifier by gravity where the biological flocs settle by gravity and clear supernatant water overflows in to a sump. The clarifier is a tank which is designed to create the right conditions of quietness to allow the settling of the sludge flocs. The mechanical scraper which is called as clarifier mechanism is provided at the bottom of the tank, which clarifies the sludge and pushes to the central collection pit and is further drawn out.

The sludge is recycled back into the aeration tank to maintain the balance between the micro organisms and the incoming food. The excess sludge is removed in to a sludge thickener. The sludge recirculation pumps are provided for with drawing the sludge from the clarifier.

Mineralization

As mentioned above, working with an aged sludge, the mineralization phenomenon takes place; this phenomenon allows the transformation of the organic substance from which the bacteria are made of and the BODs present in inorganic salts, like NO3, SO4, PO4, etc. The same phenomenon takes place in the treatment plants where the sludge quantity produced is very low because the residence time value is high and the F/M value and the volumetric load (Kg BODs/m^3 tank) are very low.

It is clear that in order to obtain all this it is important to keep under control all the other important parameters in order to balance the whole process. Another important process data regards the upward speed on the final decanters that for safety reasons should be kept between 0.3-0.4 $m^3/m^2/h$. This way, the SS quantity in the end will be very low and it will not be necessary to dose any chemical product in order to enhance the sludge separation.

As it can be seen, several parameters must be kept under control, but this allows us to guarantee a high quality process with low running costs, moreover, it allows us to deliver an outlet water with the best quality for it to be reused after it has gone through the reverse osmosis membranes.

At this point, we would only like to emphasize that for several years this process has been used successfully and that in most countries of the world this kind of treatment plants are currently operative. This guarantees that the choice for Tirupur is based on a long lasting experience, that can be applied to any working situation.

B. The sludge line section consists of the following:

- Sludge re-circulation and excess sludge extraction.
- Sludge storage and thickening

a) Sludge recirculation

Certain portion of the sludge is pumped back from a collecting sump to the biological oxidation tank continuously. This sludge provides to keep the bacteria mass well balanced and it makes their regular and intense growth possible. During the start up of the plant, when a quick bacteria growth is required, the sludge is totally pumped back.

b) Sludge storage and thickening of excess sludge

Before a further treatment of dewatering and compacting i.e. filter press the excess sludge is thickened in a storage tank (thickener) where a reagent, cationic polyelectrolyte, is dosed to improve the thickening process.

c) Solids separation and dehydration – Filter press

The sludge produced by the biological sections will be removed by means of piston pump towards a filter press and after treatment; it will have a dry value of about 25%. The effluent of the filter press will be recycled back to the biological oxidation tank, while the dehydrated sludge would be used as fertilizer in agriculture or destined to disposal.

Sodium hypochlorite dosing system

The chlorination facility has been provided to chlorinate the final treated water in the softened water storage tank. This chlorination is to sterilize the storage tank and prevent the growth of micro organisms in the tank. These micro organisms will develop in to a colony and contribute the bio fouling of the RO membranes thus leading to decreased RO permeate and other problems in the RO plant.

The residual free chlorine of 0.5 to 1.0 ppm is maintained in the feed water to the RO plant. The free chlorine helps in preventing the bio growth in the pressure sand filters. The bacterial growth inside the sand filter will lead to the formation of mud balls and results in poor performance of the filters. The free chlorine helps in preventing the mud ball phenomenon.

There is Quartz filter, Resin filter, & softener filter so that the hardness of the treated water should be around 20ppm.

<u>Description of various Instruments in Pretreatment Section</u>

Description	Details
pH meter	Range: 0 to 14 Display: liquid crystals MOC of electrode holder: PVC
DO meter	Range: 0-15mg/l Display range temperature: 0-60 °C
Flow meter	Sensor type: magnetic Function: counter-Tot
Turbidity meter	Type: Gravity Nephleometric Range: 0-100 NTU
Testomat	Operating pressure: 1-8 bar Flow: 5-25 lt/min Type of measurement: Continuous

RO Treatment Plant

Following treatment steps are envisaged in the RO process:

- a) Pressure sand filtration,
- b) Dechlorination
- c) Micron filtration
- d) Antiscalant dosing
- e) RO-stage-1
- f) RO-stage-2
- g) Degasser tower
- h) RO product water storage and distribution.

3.4.2 Process description

The treated water from biological section after passing through resin filters is collected in the resin filter storage tank and is drawn by centrifugal pumps, and is passed through pressure sand filters to remove any possible suspended solids formed due to the addition of sodium hypochlorite in the resin filter storage tank (pretreatment section). The filtered water is collected in a sump, from where this water is pumped to a set of cartridge filters loaded with 5-micron (nominal rating) polypropylene fiber, honeycomb type cartridge filter elements.

It should be noted that we have provided a chlorination system to prevent the growth of microorganism in the resin filtered water storage tank. As a result of this there is a possibility of calcium carbonate precipitation and formation of fine suspended particles. In order to remove these suspended particles of calcium carbonate, we have provided the pressure sand filter.

The pretreatment scheme proposed for our RO plant is based upon the quality of RO feed water characteristics and the Silt Density Index at the outlet of resin filter, which is expected to be less than 5.0. Besides the quality of feed water, we have two stages of filtration prior to feeding the RO membranes. The two stages of filtration comprise of a coarse sand filtration followed by the fine filtration through 5 microns cartridge filter elements. These ensure the removal of any fine particles of less than 5 microns and further reduce the Silt Density Index.

This PSF filters and RO

The ultra filtration system performance is not quantified as of date, from the viewpoint of RO membrane life and UF manufacturers do not commercially guarantee the life of RO membranes. In view of this, there is no technical or financial benefit derived out of installing the UF system as a pretreatment prior to the RO plant. Therefore, the need for capital intensive Ultra filtration system and its own share of membrane replacements is not envisaged.

The RO system will have the chemical cleaning facilities to recover the RO membranes whenever there are any symptoms of either fouling or chemical scaling as recommended by the membrane suppliers. Whenever the RO yield comes down by 10% or the differential pressure across the membrane pressure vessels increases by about 10% and if the permeate quality deteriorates from the normal values the chemical cleaning of the membranes is initiated.

The fouling of the RO membranes occurs due to the growth of micro organisms and metallic oxides. The nature of fouling determines the chemical required for cleaning. The chemicals normally used are caustic soda for biological growth and hydrochloric acid is used for the removal of metallic oxide fouling.

The chemical scaling of the concentrate side occurs due to the precipitation of the salt which exceeds their solubility, and such scaling is removed by cleaning with hydrochloric acid, citric acid, EDTA with caustic soda and various other chemicals. The concentration and chemical cleaning time etc are recommended by the membrane suppliers and is established based on the experience.

Multiple effect evaporation plant

Feed of 3.5% TDS from RO reject tank is pumped to the feed pre-heater, a plate heat exchanger, where the preheated from ambient temperature to approximately 55 deg. C. by exchanging the heat of hot condensate from the evaporator.

The preheated feed is then fed to seven effect falling film vacuum evaporator with suitable vapor compression system (for enhancing the steam economy), where the feed is heated above the boiling point in a shell & tube heat exchanger using dry saturated steam and flashed into the vapor separators to separate vapor and the concentrate. The separated vapor is then fed to shell side of the next calandria to heat the concentrate further by condensing on the tubes. The concentrate is pumped through the evaporator train and at the final effect it reaches a concentration of 27% total solids. The concentrate is cooled to 40 deg. C by cooling water in the concentrate cooler, a plate heat exchanger.

The concentrate at 40 deg. C. is fed to the cooling crystallizer. A three-stage steam ejector system serves to create a vacuum of approximately 10 Torr (750 mmHg) for making the concentrate supersaturated. The sodium sulphate crystals, formed during the crystallization, are separated from mother liquor in a centrifuge.

The mother liquor of 15% total solids is fed to a double effect falling film and a single effect forced circulation evaporator with suitable vapor recompression system and heated by dry saturated steam. The water is evaporated from the concentrate and condensed using a condenser. The final concentrate of 50% total solids is fed to the solar evaporation pond for further evaporation.

The concentrated liquor from the outlet of falling film evaporator which is of 27% total solids and at 40 deg. C. is fed to the cooling crystallizer. The crystallizer is a closed insulated vessel which operates under a vacuum of about 750 mm Hg. Three stage steam ejector with inter stage barometric condenser is provided to create the desired level of the vacuum in the crystallizer. The sodium sulphates crystals that are formed during the crystallization process are separated from mother liquor in a centrifuge.

Multiple effect evaporator

ZLD

The CETP has been installed to treat raw textile effluent on a Zero Liquid Discharge basis. The recovered water and salt is returned to the industries for reuse. There will be no liquid waste water discharge to the outside environment.

Zero Liquid Discharge Plant

EQUIPMENT DETAILS:

Sl.no	Description	No.of Units	Dimension
1	LiftingStation(NearSakthiBalaProcess)	1	2.5Diax15.0Ht
2	PumpingStation-1intheconveyance system	1	3.0Diax7.5Ht
3	PumpingStation-2WithintheCETP premises	1	7.20diax10.5Ht
4	Bar screen	1	7.6x1.0x1.0
5	StoragecumHomogenization Tank	1	23.6X82.4X6.0
6	NeutralizationTank	1	36.86Sq.mx6.0Ht

7	CoolingTowerforBIOT Feed	2	250m3/hreach
8	DistributionTank	2	44.39Sq.mx6.5
9	BiologicalOxidationTanks	3	71.9x17.8x6.03
10	SedimentationFeedTank	2	5.2x4.4x5.78
11	Clarifier	2	31.0DiaX2.7Ht
12	SludgeReturn Sump	2	3.0x4.0x5.15
13	SludgeThickener	1	7.0Dia.x3.5Ht
14	Filter Press	2	32m³/Day-81Plate
15	VolutepresswithdryerforBiosludge	1	Capacity-25m3/hr
16	HypoContactTank	1	23.0x12.0x5.0
17	TreatedEffluentStorageTank	1	3.5x18.0x5.1
18	QuartzFilter	6	3.3diaX3.4Hteach
19	QuartzFilterWaterStorageTank(QWST)	1	8.5x12.0x5.8
20	ResinFilterconvertedintoQuartzFilter	6	3.2diax3.4ht-each
21	QuartzFilterWaterStorageTank(RWST)	1	8.5x23.0x5.9
22	SoftnerFilter	11	1.8diax2.8ht-each
23	SoftenerWaterStorageTank(SWST)	1	8.5x11.0x6.0
24	BackwashDischargetoResinFilter(BDTRFS)	1	2.2x7.2x3.0
25	RCMixingTank(Reactor Clarifier)	1	8.0x4.5x4.0
26	RCFeedTank	1	4.5X4.5X4.0
27	ReactorClarifier	1	7.5Diax4.0ht
28	HRSCCClarifier	1	11Diax4.0ht
29	RCSupernatantTank	1	4.5X4.5X4.0
30	ROPressureSandFilter	5	3.1diax3.5Ht-each
31	FilterPressforChemicalsludge	1	32m3/Day-81Plate
32	UltraFiltrationSystem-3MLD	2	Each-48Membranes
34	CartridgeFilterFeedTank(CFFT)	1	10.2x7.03x3.54
34	MicronCartridgeFilter	3	455m3/hr
35	ROBank(4 Stages)	3	SW-882Membranes
36	AdditionalStageRO(VStage)	1	SW-78Membranes
37	AdditionalStageRO(VIStage)	1	SW-55Membranes
38	AdditionalStageHighpressureRO(VIIStage)	1	SW-20Membranes
39	RODegassingTower	1	3.0Diax4.6ht
40	ROCIPTank	1	5650LtrsFRPTank
41	ROProductStorageTank(RPWST)	1	19x15.4x3.54
42	AdditionalROProductStorageTank(RPWST)	1	5000KL

43	RORejectStorageTank	1	19.0x3.54x7.63
44	AdditionalStageRORejectTank	1	20.8X13.2X3.9
45	6th&7thROFeedTank-1	1	20.8X13.2X3.9
46	6th&7thROFeedTank-II	1	6.5x3.2x4.0
47	CondensateStorageTankforEvaporators	1	13.2x12.0x2.6
48	FallingFilm Evaporators	1	5Effect- 500m3/day
49	FallingFilmFeedTank	1	13.35x5.0x4.1
50	BrinePreparationTank	1	8.0x11.2x3.5
51	BrineDistributionTank	1	10.2x6.5x4.0
52	ChillerCrystalizer	1	1500kg/hr
53	CrystalizerFeedTank-I	1	12.0x3.0x2.6
54	CrystalizerFeedTank-II	1	4.0x6.5x4.0
55	MotherLiquorStorageTank	1	3.4x1.8x2.2
56	MEEForcedCirculationEvaporator	1	150 KLD
57	MEEForcedCirculationFeed Tank	4	10x6.5x4-260m3each
58	AdditionalMEE	1	3FFand3FCE-500KLD
59	AdditionalMEEFeedTank	4	5.2x7.5x4-156m3-each
60	AdditionalMEE&FCEMLTanks	4	5.3x6x2-63.6m3-each
61	FilterPressformixedsaltinMEE	1	60 Plate
62	FilterPressformixedsaltinMEE	1	40 Plate
63	ATFDFeedTank1&2	2	9.7x6.7x1.2-80m3-eac
64	ATFDFeedTank3&4	2	6.7x6.9x1.2-55.4kL
65	AgitatedThinFilmDryer(ATFD)	1	20KLD
66	AgitatedThinFilmDryer(ATFD)	2	15KLDeach
67	SolarEvaporationPan	1	449.4Sq.mtr

Parameter	Raw Effluent
pH @ 25^{0}C	8.5 – 10.0
EC @ 25^{0}C	10,000 – 12,500
TDS (organic)	250 – 500
TDS (inorganic)	6000 - 7000
TSS	60 – 80
Chloride as Cl^-	200-300
Sulphate, SO_4^{2-}	2500-3000
Oil &grease	10 – 20
BOD_3 @ 27^{0}C	300-500
COD	1000 - 1200
Total Hardness as $CaCO_3$	500 – 900
Ca (Calcium) – Hardness	200 – 400
Mg (Magnesium) – Hardness	250 – 550
Carbonate Hardness as $CaCO_3$	500 – 900
Total alkalinity as $CaCO_3$	700 – 1000
M- alkalinity as $CaCO_3$	700 – 1000
P-alkalinity as $CaCO_3$	20 – 80
Color	Dark colored
Turbidity (NTU)	100-200
Carbonate as CO_3	30 - 100
Bicarbonate as HCO_3	700 – 1200
Total phosphate as P	2.00 – 4.00
Fluorides as F	3.00 – 4.00
Nitrate as N	3.00 – 6.00
Ammonical nitrogen (NH_4-N)	2.00 – 6.00
Total Kjeldal Nitrogen as N	10.00 – 40.00
Iron as Fe	0.50 – 2.00
Sodium as Na	2000 – 2500
Potassium as K	40 – 60
Barium as Ba	0.15 – 0.25
Boron as B	0.50 – 1.00
Aluminium as Al	0.10 – 1.20
Zinc as Zn	0.05 – 0.50
Lead as Pb	0.10 – 0.25
Manganese as Mn	0.05 – 0.10
Copper as Cu	0.10 – 0.20
Chromium as Cr	0.00 – 0.05
Cobalt as Co	0.05 – 0.10
Nickel as Ni	0.10 – 0.20
Cadmium as Cd	0.04 – 0.06
Arsenic as As	BDL
Total Silica as SiO_2	20.0 – 40.0
Strontium as Sr	1.00 – 2.00

Note: All parameters are expressed in mg/l except pH (number) and EC (micro mhos/cm)

Fig- Characteristics of Combined Raw effluent

A.9. Implementation Benefits to Water Security

Textile industry effluents contain a variety of chemicals, including hydrogen peroxide, sodium hypochlorite, sodium hydrosulfite, and sodium dithionite, along with smaller amounts of phosphates, nitrates, and salts of sodium and calcium. Additionally, the use of sodium chloride for preservation and pickling, as well as sulfate salts (primarily basic chromium sulfate) in dyeing and finishing processes, contributes significantly to the total dissolved solids (TDS) in the effluent. Various finishing operations further add to the salt load in the wastewater.

It is noted that the bulk of the hydrogen peroxide, sodium hypochlorite, sodium hydrosulfite emanates from the operations and the dying operations from semi-processed (EI/Wet blue) to finishing of washing result in effluent containing TDS, on a lower scale, mostly in the form of sulphates.

The implementation of ETPs has been crucial in safeguarding aquatic ecosystems in Noyyal River and soil health by effectively treating this harmful effluent.

Recycling wastewater from Dying and returning it to the production process after treatment is a pivotal step toward sustainability. This circular approach significantly reduces the reliance on groundwater, a precious natural resource. By minimizing the demand for fresh water, dying industries can contribute to water conservation efforts and alleviate pressure on depleting aquifers.

This project aims to inspire all Textile industries, particularly large multinational corporations, to implement sustainable water management practices. By demonstrating effective strategies for reducing captive water consumption and responsibly managing groundwater, the project hopes to foster a broader adoption of environmentally responsible approaches within the industry.

A9.1 Objectives vs Outcomes

The impact assessment or objectives of this project activity can generally be enumerated as follows:

- The project activity highlights the catalytic role that corporate India must play vital role in reducing industrial water consumption as well as water pollution per unit of industrial output.
- The PP has showcased technology that creates safe industrial grade water from an effluent source and has overcome the challenges faced by the alternate methods implemented and/or being proposed for the same.
- The PP has showcased the successful wastewater treatment of industrial effluent, thus saving millions of liters of wastewater for the production of Lether.
- The project activity showcases best-in-class wastewater treatment technology that can replace the equivalent freshwater and industrial demand in different sectors for nonportable purposes

while reducing the proportion of untreated wastewater and substantially increasing recycling and safe reuse in India.

A9.2 Interventions by Project Owner / Proponent / Seller

The project aligns with sustainable resource management by prioritizing the reuse of treated effluent over depleting groundwater sources. The PP has voluntarily invested in treating and reusing effluent, conserving millions of liters of potable water for the city.

As population growth and rising living standards increase water demand, groundwater, which supplies 85% of rural areas, faces increasing pressure. Overexploitation has led to declining water tables, water shortages, saltwater intrusion in coastal regions, and higher energy costs for pumping.

The PP's initiative has directly contributed to water security in the region. By avoiding excessive groundwater extraction, the project helps mitigate issues like falling water levels, water scarcity, saltwater intrusion, and increased energy consumption for pumping.

A.10. Feasibility Evaluation

The installed CETP and ZLD System by the PP are robust and smoothly adapts to variations in wastewater effluent. Before establishing the project, PP has done the feasibility test as per **DPR** (Detailed Project Report)

A.11. Ecological Aspects & Sustainable Development Goals (SDGs):

This project demonstrably achieves sustainable management and efficient utilization of India's natural resources. The project proponent (PP) had the option to install borewells, potentially depleting local groundwater reserves. Alternatively, they could have continued relying on existing, potentially potable, water resources registered with the Universal Water Registry.

Recognizing the environmental impact, the PP commendably opted for a more sustainable approach. They chose to treat and reuse the effluent generated by the Common Effluent Treatment Plant (CETP), resulting in significant water savings for the dying operations, measured in millions of liters.

This project encourages the industrial sector, particularly large-scale leather processing facilities, to adopt similar sustainable practices regarding their captive water needs and overall groundwater management.

The CETP effectively treats the textile's effluent, and the use of impervious machinery within the CETP area further safeguards against potential leakage and contamination of surrounding soil.

The sustainable development attributes attached to the project activity are demonstrated below:

Sustainable Development Goals Targeted	Most relevant SDG Target/Impact	Indicator (SDG Indicator)
	13.2: Integrate climate change measures into national policies, strategies and planning	Recycling and reusing wastewater is an effective solution for climate change adaptation because it helps mitigate the impacts of droughts, floods, and other extreme weather events that are becoming increasingly common due to climate change due to water scarcity. The quantity of wastewater recycled and reused by the PP is the SDG indicator.
	3.9: By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination	The PP showcases how recycling and reusing wastewater can prevent depletion of natural water reserves and prevent water scarcity during droughts. The hazardous impact of industrial wastewater is now avoided due to this project. The PP ensures water availability in water-scarce zones that help promotes healthy lives and well-being in the region.
	6.3: By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally	The PP has showcased recycling and safe reuse of 10.9 million liters within the industry during this monitored period, which directly correlates to this indicator 6.3.

8 DECENT WORK AND ECONOMIC GROWTH	8.5: By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value	Number of jobs created and also the Number of people trained as part of this project activity.
15 LIFE ON LAND	15.2.1 Progress towards sustainable forest management.	The PP has implemented a reforestation project in the nearby area to revitalize the local ecosystem.

A.12. Recharge Aspects :

NA

Water Budget Component	Typical Estimated Uncertainty (%)	Description
Surface Inflow	1%	In accordance with the RoU Standard version 7, and considering that the flow meters are calibrated, PP has accounted for a 1% uncertainty factor in both inflow and outflow volumes to maintain a conservative approach. Consequently, an uncertainty factor of 0.98 is applied to all ROUs.
Precipitation	NA	Not available
Surface Outflow	1%	In accordance with the RoU Standard version 7, and considering that the flow meters are calibrated, PP has accounted for a 1% uncertainty factor in both inflow and

		outflow volumes to maintain a conservative approach. Consequently, an uncertainty factor of 0.98 is applied to all ROUs.
Evapotranspiration	NA	Not available
Deep Percolation	NA	Not available

A.13. Quantification Tools

Baseline scenario:

The baseline scenario is the situation where, in the absence of the project activity, the PP would have **one or all** of the below options:

- (a) installed multiple bore wells within the project boundary which would have depleted the local groundwater resources (aquifers); **and/or**
- (b) diverted existing safe drinking water resources from the surrounding residential area; **and/or**
- (c) discharged the ETP effluent without further recycling and reuse.

Hence the following baseline scenario is applicable for this project activity:

"The net quantity of treated ETP effluent / wastewater that would be discharged directly into the local drain/sewer without further being recycled and/or reused daily post treatment per year"

The net quantity of treated water used is measured via flow meters installed at the site. The primary set of data records are kept at plant level, managed by Tirupur CETP team which is Mentioned in Appendix. Also, for conservative purposes, the working days or operational days have been assumed at 330 days in a year during the 1st monitoring period **(01/01/2014 to 31/12/2023)**. However, the number of days is not an influential parameter on RoUs calculation as RoUs are calculated based on total quantity of treated water being recycled & reused.

Year	RAW EFFULUENT RECIVED	RO PERMEATE	BRINE	RoUs with Uncertainity Factor ([Ro per+Brine)*0.98
2014	363693	336287	18963	348145
2015	411192	408210	18738	418409
2016	453079	413629	17716	422718
2017	592928	534085	21477	544451
2018	679803	613319	23768	624345
2019	822823	712921	49357	747032
2020	820528	749762	29329	763509
2021	1026373	935779	37832	157181
2022	975223	910742	33205	925068
2023	974246	986762	31828	998218
				5,949,077

Quantification

Year	Total ROUs (1000 liters)/yr UCR Cap(1 million RoUs/yr
2014	348145
2015	418409
2016	422718
2017	544451
2018	624345
2019	747032
2020	763509
2021	157181
2022	925068
2023	998218
Total RoUs	**5,949,077**

A.14. UWR Rainwater Offset Do No Net Harm Principles

According to the UCR RoU Standard principles, the project activity accomplishes the following:

• Increases the sustainable water yield in areas where over development has depleted the aquifer
According to the data released by the Central Groundwater Board in 2021, the total amount of groundwater that can be utilised in India in a year is 398 billion cubic meters (BCM), of which, approximately 245 BCM is currently being utilised, which is about 62 per cent of the total. But the level of exploitation of groundwater is very high in States like Punjab, Rajasthan, Haryana, Delhi and Tamil Nadu. This project activity was commissioned in 1995, and the PP has reduced the proportion of untreated wastewater that future generations would need to recycle and has showcased recycling and safe reuse within the industry from unutilized water resources. Revenue from the sale of UCR RoUs will enable scaling up of such project activities.
• Collect unutilized water or rainwater and preserve it for future use
In India, at the district level, in 24 states/UTs, as many as 267 districts had stages of groundwater extraction more than 63 per cent, ranging from 64 per cent to 385 per cent (source: https://www.business-standard.com/article/current-affairs/from-58-to-63-india-pumped more-groundwater-between-2004-and-2017-121122101377_1.html). This project activity serves as an example to recycle and reuse wastewater and encourages companies, especially large and transnational companies in the biotechnology and biopharmaceuticals sector, to adopt similar sustainable practices in regard to captive water requirements and groundwater management.
• Conserve and store excess water for future use
The project activity decreases the dependence on groundwater, thereby preventing excessive depletion. Between 2008 to 2023, the project activity has reused 10.9 million litres of ETP effluent successfully post treatment with gainful end use of the same.

A.15. Scaling Projects-Lessons Learned-Restarting Projects

The Common Effluent Treatment Plant (CETP) at Murugapalyam, Tirupur, which has been designed to treat 10.9 m^3/day of effluent from hosiery bleaching and dyeing units, demonstrates an advanced approach to wastewater management and Zero Liquid Discharge (ZLD). Scaling up this project to other regions and sectors requires leveraging existing integrated practices while addressing areas where duplication can be minimized. Below are strategies for scaling the project and enhancing water and urban management:

Scaling up the Common Effluent Treatment Plant (CETP) model, such as the one at Murugapalayam in Tirupur, can significantly improve water and wastewater management in India's dyeing industry. This CETP, designed to achieve Zero Liquid Discharge (ZLD) by treating 10.9 m^3/day of effluent, serves as an effective example of how centralized wastewater treatment can be scaled to other textile clusters like Ahmedabad, Jaipur, and Surat, where water-intensive dyeing and textile industries are prevalent. These areas could adopt similar CETPs, customized to meet their specific wastewater volumes and environmental conditions. A cluster-based approach, where small and medium-sized dyeing units share a common treatment facility, can lower operational costs, ensure uniform quality of effluent treatment, and reduce the environmental risks associated with untreated wastewater.

To optimize water recovery and treatment processes, scaling the CETP model could involve upgrading existing systems with advanced technologies such as membrane bioreactors (MBRs), ultrafiltration, or nanofiltration, which provide higher quality treated water. Additionally, improving Reverse Osmosis (RO) systems and enhancing brine management will be crucial. Brine concentrates, which typically contain high levels of salts, can be treated to recover valuable by-products like sodium chloride and sodium sulphate (Glauber's salt), which could be sold or repurposed in other industries, such as agriculture or construction. By maximizing resource recovery, CETPs can contribute to a zero-waste model, reducing the environmental footprint of dyeing industries and generating economic value.

Effluent reuse within the dyeing process is another area where scaling can have a significant impact. By implementing closed-loop systems where treated water is recycled back into the dyeing units, the industry can reduce its freshwater intake and minimize wastewater discharge. Dedicated pipelines connecting CETPs to individual dyeing units can streamline this process, ensuring treated water is efficiently delivered for reuse in dye baths or washing processes, further conserving valuable water resources.

Another key aspect of scaling up CETPs is integrating these systems into urban water management strategies. In regions where CETPs are established, treated effluent could be directed to municipal systems for non-potable uses, such as street cleaning, public park irrigation, or cooling in commercial complexes, thus reducing demand on potable water supplies. In larger cities, collaborations between industry stakeholders and municipal water management authorities could lead to the broader adoption of water reuse practices in urban planning.

Resource recovery from the effluent treatment process also offers a significant opportunity for waste minimization and economic growth. For example, sludge generated during treatment can be analyzed for recoverable materials, such as heavy metals or organic compounds, which can be reused in other industries. Additionally, energy recovery from organic matter in wastewater, through biogas production or other methods, can help power CETP operations, making the system more energy-efficient and reducing its reliance on external power sources.

Public awareness and community engagement play a crucial role in the successful scaling of CETPs. Educating local communities and industry workers about the safety standards, the benefits of wastewater treatment, and the potential for water recycling will help build trust in the system. Targeted communication campaigns can address misconceptions about treated water, emphasizing that it is safe, well-regulated, and beneficial for both industries and urban areas. Case studies of successful water reuse projects can be showcased to demonstrate the long-term benefits of these technologies.

To encourage the scaling of CETPs, government policies and incentives will be vital. Financial incentives or tax breaks for industries that adopt ZLD systems, wastewater recycling, and resource recovery technologies could accelerate their adoption. Additionally, stricter regulations mandating ZLD in water-intensive industries, coupled with streamlined approval processes for CETP projects, would help drive the adoption of best practices in water and wastewater management. Integrating CETP efforts into larger urban water management frameworks will further ensure that treated effluent is put to productive use, creating a circular water economy.

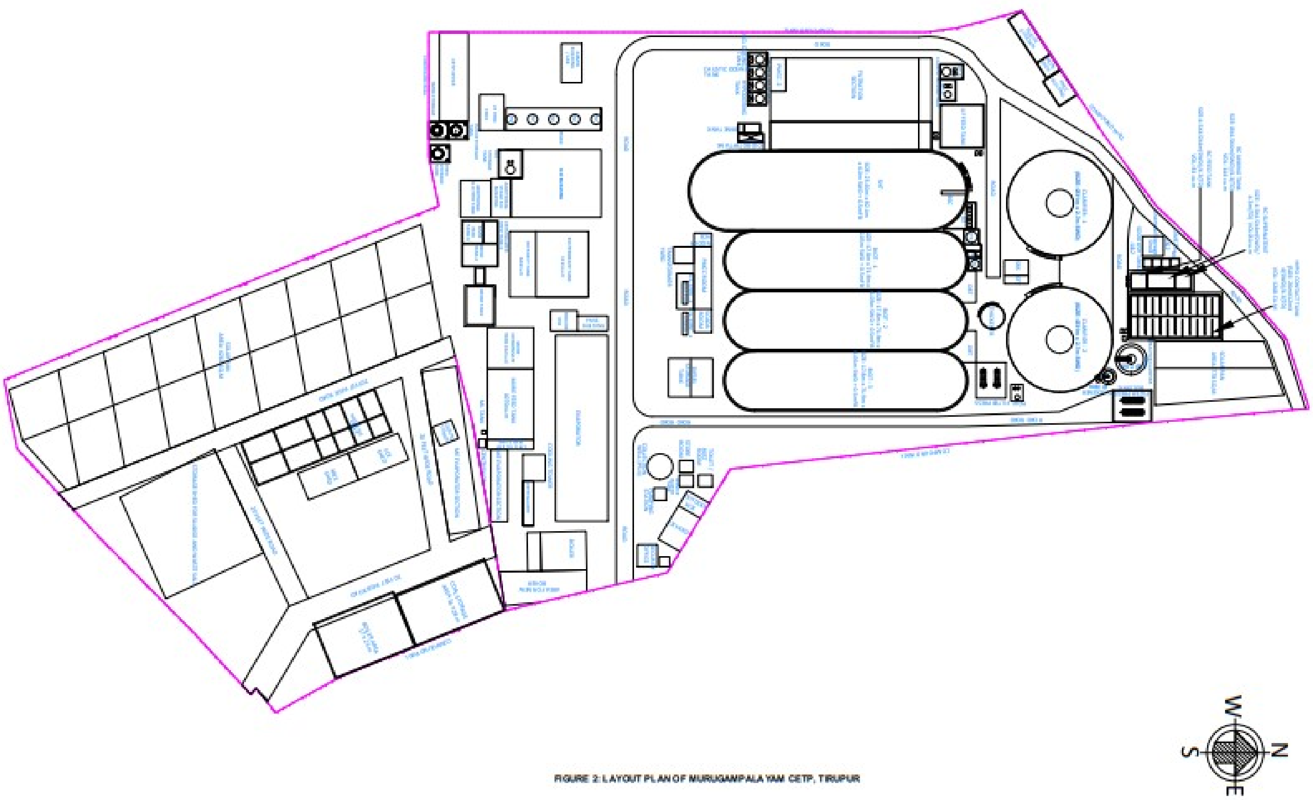


FIGURE 2: LAYOUT PLAN OF MURUGAMPALAYAM CETP, TIRUPUR

Plant Layout of Tirupur Murugapalayam CETP

Category of the Industry :

RED

CONSENT ORDER NO. 2405158126948 DATED: 15/04/2024.

PROCEEDINGS NO.T5/TNPCB/F.0483TPN/RL/TPN/W/2024 DATED: 15/04/2024

SUB: Tamil Nadu Pollution Control Board –CONSENT TO OPERATE – DIRECT -M/s. TIRUPPUR MURUGAMPALAYAM COMMON EFFLUENT TREATMENT COMPANY PVT. LTD. , S.F.No. 214/2, VEERAPANDI village Tiruppur south Taluk and Tiruppur District - Consent for the operation of the plant and discharge of sewage and/or trade effluent under Section 25 of the Water (Prevention and Control of Pollution) Act, 1974 as amended in 1988 (Central Act 6 of 1974) – Issued- Reg.

Ref: 1.Board Proc.No.T5/TNPCB/F.0483TPN/RL/TPN/W&A/2023 dated : 29.03.2023

2.DEE, TPR(N), IR.No:F.0483TPN/RL/AEE/TPN/2024 dated 26.03.2024

3.CCC Resolution vide Item No. 322–1, dated: 10.04.2024

CONSENT TO OPERATE is hereby granted under Section 25 of the Water (Prevention and Control of Pollution) Act, 1974 as amended in 1988 (Central Act, 6 of 1974) (hereinafter referred to as "The Act") and the rules and orders made there under to

The Managing Director
M/s . TIRUPPUR MURUGAMPALAYAM COMMON EFFLUENT TREATMENT COMPANY PVT. LTD.
S.F No. 214/2
VEERAPANDI Village
Tiruppur south Taluk
Tiruppur District.

Authorising the occupier to make discharge of sewage and /or trade effluent.

This is subject to the provisions of the Act, the rules and the orders made there under and the terms and conditions incorporated under the Special and General conditions stipulated in the Consent Order issued earlier and subject to the special conditions annexed.

This CONSENT is valid for the period ending **March 31, 2026**

S RAGUPATHI Digitally signed by S RAGUPATHI
Date: 2024.04.15 17:09:17 +05'30'

For Member Secretary,
Tamil Nadu Pollution Control Board,
Chennai

Consent of TNPCB

