

EFFLUENT TREATMENT PLANT (ETP)

Complete Engineering Flow Diagram & Standard Technical Specifications

This document contains the **complete, unit-by-unit Process Flow Diagram (PFD)** for an Industrial Effluent Treatment Plant (ETP), followed by exhaustive technical specifications for each mechanical unit across Primary, Chemical, Biological, Tertiary, and Sludge Dewatering stages.

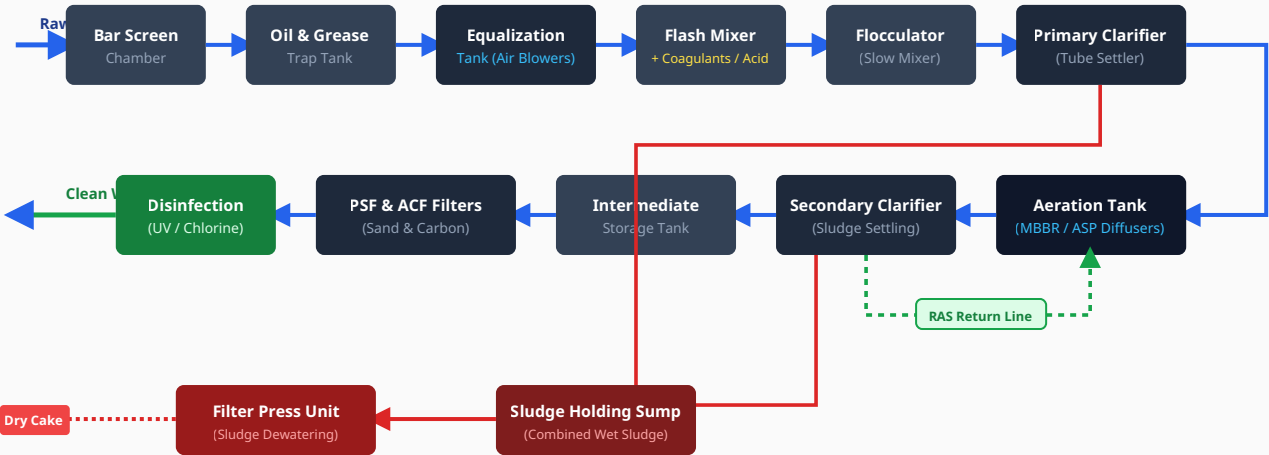


FIGURE 1: COMPREHENSIVE UNIT-BY-UNIT EFFLUENT TREATMENT PLANT (ETP) PROCESS FLOW DIAGRAM

1. PRIMARY TREATMENT ZONE (PHYSICAL & MECHANICAL)

UNIT / COMPONENT	FUNCTION & TECHNICAL SPECIFICATIONS
Bar Screen Chamber	Function: Intercepts large floating solids, rags, plastics, and debris to protect downstream pumps from clogging. Specifications: Material: Stainless Steel (SS-304) / MS Epoxy Coated; Clear Spacing: 10mm to 25mm; Type: Manual or Automatic Mechanical Rake Type.
Oil & Grease Trap	Function: Utilizes specific gravity differences to separate free floating oil, fats, and scum from the surface. Specifications: Multi-baffle wall mechanism; MOC: Civil RCC Structure / MS Fabricated with Epoxy; Equipped with Skimmer / Mechanical scraper.
Equalization Tank	Function: Homogenizes hydraulic flow rate and balances organic loads (pH, COD, BOD) coming from variable shifts. Specifications: Retention Time: 8 to 12 Hours; Coarse Bubble Air Diffuser System (to prevent solids settling and septic conditions); Connected to Air Blower.

2. CHEMICAL TREATMENT ZONE (PHYSICO-CHEMICAL)

UNIT / COMPONENT	FUNCTION & TECHNICAL SPECIFICATIONS
Flash Mixer / Neutralization	Function: Rapid mixing of coagulants (Alum, PAC) and pH adjusting chemicals (Acid/Caustic). Specifications: Agitator Speed: 300–400 RPM; Impeller MOC: SS-316 / High-Grade Polymer; Automatic pH Dosing Pump setup.

UNIT / COMPONENT	FUNCTION & TECHNICAL SPECIFICATIONS
Flocculation Tank	Function: Slow agitation to promote collisions among destabilized particles, forming larger settleable flocs. Specifications: Slow-speed Paddle Agitator; Speed: 20–40 RPM (VFD controlled to prevent floc shear); Retention Time: 20–30 Minutes.
Primary Clarifier / Tube Settler	Function: Gravity separation of flocs and suspended solids from liquid phase. Specifications: PVC/PP Tube Settler Media Pack; Inclination Angle: 60° for optimal settling efficiency; Hopper Bottom Sludge Collection Pit.

3. SECONDARY TREATMENT ZONE (BIOLOGICAL)

UNIT / COMPONENT	FUNCTION & TECHNICAL SPECIFICATIONS
Aeration Tank (MBBR / ASP)	Function: Aerobic digestion of dissolved organic pollutants (BOD & COD) using active microorganisms. Specifications: Fine Bubble Membrane Diffusers (Silicone/EPDM); Target DO: 2.0 – 3.0 mg/L; MBBR Media Filling Ratio: 30% – 50% (if MBBR technology is applied).
Secondary Clarifier Tank	Function: Separates biological biomass (sludge) from treated supernatant water. Specifications: Sludge Scraper Mechanism; Return Activated Sludge (RAS) Pumps installed to recycle active bacteria back to the Aeration Tank.

4. TERTIARY TREATMENT ZONE (FILTRATION & POLISHING)

UNIT / COMPONENT	FUNCTION & TECHNICAL SPECIFICATIONS
Pressure Sand Filter (PSF)	Function: Traps residual fine suspended solids and reduces turbidity. Specifications: Vessel MOC: FRP / MS Epoxy Lined; Media: Graded Pebbles, Gravels, Fine & Coarse Quartz Sand; Multi-port Valve for backwashing.
Activated Carbon Filter (ACF)	Function: Adsorbs color, odor, residual chlorine, and trace organic contaminants. Specifications: High Iodine Value Granular Activated Carbon (> 900 mg/g); Sized to match PSF design flow rate.
Disinfection Unit	Function: Eliminates pathogenic micro-organisms and bacteria prior to water discharge or reuse. Specifications: Sodium Hypochlorite Chemical Dosing System / In-line Stainless Steel UV Sterilizer System.

5. SLUDGE MANAGEMENT SYSTEM

UNIT / COMPONENT	FUNCTION & TECHNICAL SPECIFICATIONS
Filter Press / Decanter	Function: Dewater primary and secondary sludge into dry, manageable sludge cakes. Specifications: Polypropylene (PP) Filter Plates with high-density filter cloths; Hydraulic Closing Mechanism (Manual / Motorized); Sludge Collection Tray.

Disclaimer / Note: Standard technical parameters provided above are indicative guidelines. Tank sizing, pump capacities, and chemical dosing systems should be customized according to specific raw effluent parameters (BOD, COD, TSS, TDS, and pH).