Tertiary Treatment System

a ***Types of Systems:*** "Tertiary" systems must include a biological aerobic treatment process and a physical filtration process designed to achieve an effluent quality of 10 parts per million biological oxygen demand and 10 parts per million suspended solids. A positive means of sludge handling must also be provided. Acceptable systems include extended aeration units and rotating biological contractors, followed by clarifiers and rapid sand filters, and recirculating sand filters. Design criteria for a tertiary system, including extended aeration, followed by rapid sand filtration, are presented below.

b **Location:** Treatment system must meet all horizontal setback and location requirements in the state sewage rules (10 NCAC 10A .1950(a) and shall not be located in areas subject to frequent flooding (areas inundated at a 10-year or less frequency).

c **Access and Protective Fencing:** Treatment plant must be readily accessible by maintenance vehicles and include protective fencing to limit unauthorized access.

d General Construction Guidelines:

i. **Foundation:** All plant sections must be installed on reinforced concrete pads designed to prevent unit settlement in excess of two inches and differential settlement of plus or minus one inch.

ii. **Plant walls** must be leakage proof and adequately protected against corrosion. Adjacent to coastal waters, special provisions must be made to protect steel wall surfaces from corrosive salt mists and intense solar exposure. This generally requires use of a special primer, two coats of coal tar paint, and topcoating. Cathodic protection must be in accordance with manufacturer's recommendations.

iii. **Plant access steps, service grating, and railings** must be provided sufficient to safely inspect and service all treatment plant equipment.

iv. **Electrical control panels** must be in waterproof and corrosion-resistant enclosures (NEMA 4X adjacent to coastal waters).

v. **Alarms** must be provided in all tanks with pumps. Alarms must be readily audible and visible, the alarms users and operations personnel. At remote sites, the alarms must be automatically contact a 24-hour maintenance service. Alarm systems must be installed independently of the electrical circuits for the pumps and pump controls.

vi. **Blower housings** must be in fiber glass or otherwise corrosion-resistant enclosures adjacent to coastal waters.

vii. **Flow equalization** shall be provided wherever diurnal flow surges are expected to be excessive, such as for projects serving coastal recreation area dwelling units and motels. Liquid capacity of the equalization tank must exceed 25 percent of the design daily flow. The equalization tank may also serve as the influent pump station or may be the first compartment of the treatment plant. If the latter option is selected, the tank should be designed to overflow into the main treatment plant, not back into the pump station or onto the ground. If the influent pump station is also used as the equalization tank, sufficient emergency storage capacity

above the high-water alarm on level must still be provided, as required for Sewage Pump Station, section 5c, above. Guidelines for pumps, level controls floats, dosing volume, and control panel components are the same as for Sewage Pump Station, sections 5e-g, and 5I, above. High-water alarm activation level (and lag pump on level) must be set high enough to permit adequate use of the tank storage capacity for flow equalization. Alarm level should be two feet below the overflow to the aeration tank where applicable. Method of providing for flow equalization shall be with weirs and/or delay timers. An independent means of aeration must be provided, capable of delivering 20 cubic feet per minute (CFM) per 1,000 cubic feet. The airline must be connected with main plant aeration system as a backup.

f. **Aeration Tank:** The aeration tank must be provided for at least 24 hours detention time at the design daily flow. Dual tanks are recommended adjacent to coastal waters and must be used when the design flow exceeds 50,000 gallons per day. Diffusers with adjustable air flow rates must be provided sufficient to properly mix and aerate the aeration tank.

g. **Clarifiers:** shall be designed to provide at least four hours detention time at the design daily flow, with an overflow rate not to exceed 300 gallons per day per square foot. Dual tanks must be provided when dual aeration tanks are provided. Tank length-to-width ration must exceed 1075:1. Inlet and outlet baffles must be provided to effectively prevent short circuiting. Outlet weirs must be adjustable and weir loading rate must not exceed 10,000 gallons per day linear foot. The clarifier must have one or more hopper bottoms, with an adequately-sized adjustable airlift pump for returning sludge from each hopper to aeration tank and/or sludge holding tank. The sludge return pipe and air line readily accessible for servicing. A positive, adjustable system for skimming and returning scum to the aeration chamber must also be provided.

h. **Aeration Slude holding tank:** must be provided which is readily accessible by a pump truck and shall have a liquid capacity of at least 10 percent of the design daily flow. A means for returning supernatant to the head of the plant must be provided. This should be a positive return (air lift) system which directs supernatant into equalization tank.

i. **Aeration System:** At least two blowers must be provided each capable of meeting the total aeration requirements for the aeration tank, sludge and skimmer return pumps, and any other facilities requiring use of the main air system (e.g., sludge holding tanks). Air requirements shall be computed as follows:

For the aeration tank, compute air flow based upon 3,150 CFM/pound BOD or 30 CFC/1,000 cubic feet, whichever is greater. Assume BOD concentration of 240 parts per million unless measured data indicate otherwise.

For sludge air lift pumps, 4 CFC/pump

For skimmer return pumps, 2 CFM/pump

For sludge holding tank, 30 CFM/1,000 cubic feet.

j. **Dual gravity tertiary filters:** must be provided, each sized to handle at least one-half of the design daily flow and design to operate independently. Provisions must be available for accurately adjusting the flow to each filter. Filter surface application rate must not exceed one gallon per minute per square foot at the design daily flow. Filter media depth must be 18 to 24 inches, with media specifically designed for the treatment plant and filter to be used and achieve the 10 parts per million biological oxygen demand and 10 parts per million suspended solids tertiary effluent levels. Dual media beds are generally preferred. Minimum available water depth above the filters shall be 24 inches. An air scour system independent of the backwash piping must be provided, capable of delivering at least one CFM/square foot of filter surface area. An independent blower for the tertiary filters must be provided, and the tertiary air system must be interconnected with the main plant air system to serve as a backup. Filter discharge shall be by gravity into a clear well, sized large enough to support at least a 10-minute backwash period. Dual backwash pumps must be provided, each capable of delivering at least 15 gallons per minute square foot of filter surface area, at 15 feet of total dynamic head. Pumps must be readily accessible for servicing. No solenoids or hydraulic valves shall be used in the backwash system. Backwash overflow shall be into a mud well)backwash surge tank), sized at least 5 percent larger than the clear well. Dual backwash return pumps must be provided, which shall direct backwash into the flow equalization tank at the head of the plant. Return pumps must deliver at least 1.5 times the average daily flow rate and must be valved to allow manual adjustment of the operating flow rate. Pumps and discharge pipe valves must be readily accessible. An audible alternator or timer system for switching between pumps. Mercury level control floats should be used in the filtrate holding chambers (to initiate backwash cycles), clear well (low-water cutoff), and in the mud well (to control backwash return cycles and activate high-water alarm).

k. **A flow monitoring device:** must be provided, properly sized for the expected flow range, for determining daily flow rates. Meter housing must be adequately protected from rain and from corrosion adjacent to coastal waters.

l. **Disinfection:** is required where design flow exceeds 50,000 per day and for tertiary treatment system adjacent to water supplies, shellfish harvesting areas, and recreational areas.

m. **Dosing Chamber:** See guidelines for Effluent Dosing Tank, section 10, above. The emergency storage capacity may be decreased to two hours. All pumps and level controls must be readily accessible.

n. **Standby Power:** equipped with an automatic transfer switch is required for all mechanical treatment plants. Equipment must be sized capable of independently operating entire treatment and disposal system for a 48-hour period. Unit should be automatically exercised on a regular basis.

o. **Spare parts:** to be provided included:

i. level controls floats;
ii. relays, contactors, and alternators;
iii. solenoids;
iv. filter media;
v. other equipment recommended by the engineer or manufacturer.

p. **Perfromance monitoring:** should included:

i. flow readings, daily;
ii. effluent samples for settleable solids, three times per week;
iii. effluent samples for biological oxygen demand (BOD), suspended solids, ph, nitrate and nitrite nitrogen, and ammonium nitrogen, monthly;
iv. well water table elevations (depth below surface), weekly, and ground water quality parameters recommended by the Ground Water Section of the Division of Environmental Management .

Monitoring results should be reported by a certified laboratory to the health department, quarterly