1. Designed Wastewater Flow Rate :

Wastewater flow rate (average) =708 persons×0.15 m^3/day＝ 106.2 m^3/day

Wastewater flow rate (Maximum)=106.2 m^3/day×1.2 =127.44 m^3/day

Wastewater treatment plant designed flow rate : 150 m^3/day

2. WWTP Wastewater Characteristics：

A. Influent wastewater characteristics

BOD: 200 mg/l

COD: 400 mg/l

SS : 200 mg/l

Coliform : 10000000 CFU/100ml

B. Target effluent characteristics

BOD< 30 mg/l

COD< 100 mg/l

SS < 30 mg/l

Coliform < 200000 CFU/100ml

3. Functional Calculation in each Process Treatments

1. Collecting /pumping tank

A. design parameter:

Flow rate : Q=150 CMD

HRT time=3.0hr，the total volume needed:

V=150 m^3/day×3 ÷24=18.75 m^3

B. plant calculation:

a. tank dimensions：

（1） L200×W520×H350/ D200 cm

effective tank vloume:20.8 m^3 ＞18.75 m^3----ＯＫ!

HRT timing：20.8÷150×24＝3.3(hr)

b. sewage pump

QTY=2.0 units

Design with 0.45m^3/min× 8mH ×2HP×2units（alternating operation）

2. Equalization tank

A. design parameter:

Flow rate Q=150 m^3/d

V≧〔(Q/T)-(K×Q/24)×T

design with k=1.0 , T=12 Hrs.

V≧〔(Q/T)-(K×Q/24)×T

V≧〔(150/12)-(1.0×150/24)×12

V≧75 m^3

B. plant calculation:

a. tank dimensions:：

（1） L500×W520×H350/ D320 cm

Effective tank voluem:83.2m3＞75 m3----ＯＫ!

c. actual Detention Time

DT=83.2÷150×24=13.3(hr)

d. Equalization tank pump calculation

water pump flow rate required=150m^3/d÷1440min/d=0.10 m^3/min

designed with 0.15m^3/min×6.0mH ×0.5Hp×2 units(alternating operation)

e. mixing facility calculation

designed with mixing flow =0.02m^3/m^3/min(according to government building design code)

air flow required for mixing =0.02m^3/m^3/min×83.2 m^3=1.67m^3/min

design with air blower flow rate ：2.2Nm^3/min(p=4000mmAq，Re-circulated and cooling vertical type roots blower，50MM，3HP) > 1.67 m^3/min.....OK！

There will be 16 units of φ8 ㎝ coarse bubble diffuser(6 units install in sludge storage tank, 2 units in sludge return tank)， which gives air flow rate per diffuser around 0.09m^3/min.

3. Aerobic Tank (Submerged attached Growth Process) filled with **Matala**® contact media：（estimate BOD removal efficiency : 85%）

A. design parameter:

Flow rate=150m^3/d

BOD load=150×(200-30)×0.9÷1000=23.0 kg/d

Designed BOD volumetric loading rate=0.3 kgBOD/ m^3·d (serina's note : designer use fare conservative data, as from our research data, we do suggest 0.5 kgBOD/ m^3·d at V_{media}/V_{tank} ratio=47%, and 1.0 kgBOD/ m^3·d at V_{media}/V_{tank} ratio=60%,)

Tank volume required：23.0 /0.3 =76.7 m^3

B. Plant calculation:

a. tanks dimensions:

(1)L250×W520×H350/ D315 cm^3

（2）L250×W520×H350/ D315 cm^3

Matala (SM150) Contact media total surface calculation:

Matala total surface are: 150m^2/m^3 x 30 m^3 = 4500 m^2

Matala surface loading rate : 23.0 kgBOD/day ÷ 4500m^2 ÷1000 =5.1g BOD/m^2-d

--------(OK)

b. Actual Volume：

Tank effective volume：81.9 m^3 > 76.7 m^3……OK

Design with Matala contact media filling rate：V_{media}/V_{tank} =55%

Matala contact media total volume =(L150×W520×H350)×2×0.55 =30 m^3

Total volume of Matala contact Media：30 m^3

c. Actual Detention Time

DT=81.9÷150×24=13.1（hr)

d. Actual BOD load

L=23÷81.9=0.28 kg/ m^3·d

e. Air flow calculation

aeration air flow：1.5 m^3AIR/ m^3-V-HR(according regulation)

total air flow required：81.9×1.5 / 60 =2.05 m^3/min

f. Air Blower flow rate calculation:

design with 2.2Nm^3/min(p=4000mmAq，Re-circulated and cooling vertical type roots blower, 50MM，3HP)＞2.05 m^3/min..OK！

26 units of fine bubble disc diffusers, air flow rate per diffuser is around 0.08m^3/min.

g. Back Wash :

Air back wash. 26 coarse bubble disc diffuser with 3HP Re-circulated and cooling vertical type roots blower. (air flow rate per diffuser is around 0.08 m^3/min.

4. Final sedimentation tank

A. Design Parameter:

Flow rate：150m^3/d

Detention time： ＞3.0 hrs

Surface loading rates：＜25m^3/m^2.d

Weir Loading Rates： ＜50 m^3/m/d

B. Plant calculation:

a. tank dimensions:

（1）L300×W300×H350/ D310

b. Actual volume

V=27.9×0.8=22.3m^3

c. Actual Detention time

DT=22.3÷150×24=3.5（hr) > 3hrs OK！

d. Actual surface loading rate

designed surface area=9.0 m^2

actual surface load rate =150÷9.0=16.7m^3/ m^2·d< 25 m^3/ m^2·d

e. Actual Weir Loading Rate:

Designed Weir Length=4.0 m

Actual Weir Loading Rate=150÷4.0=37.5 m^3/ m.d< 50 m^3/ m·d

f. pump in final sedimentation tank

QTY=2.0 units（time pre-set operation）

Sludge estimate quantity =1.5m^3/day

Sludge discharge time =30 mins

Sludge pump capacity calculation=1.5m^3/d÷30 min÷=0.05m^3/min

Pump head required =6.0m

（calculated head loose : 20% from the tank depth which caused by horizontal, elbow, check valves, piping etc..

Designed with water pump of 0.15 m^3/min×6.0mH × 0.5 Hp×2 units(interchange operation by pre-set timing)

5. Disinfection Effluent tank

A. Design Parameter:

Flow rate=150m^3/d

HRT= 2.0 hrs

Tank Volume required =150m^3/d×2.0÷ 24 =12.5m^3

B. Plant Calculation:

a. Tank Dimensions：

（1）L200×W300×H350/ D250

b. Effective Volume

V=15 m^3 >12.5 m^3

c. Actual Detention Time

DT=15÷150×24=2.4（hr） > 2.0 hr　OK！

d. Effluent tank water pump calculation(designed with 8hrs operation)

Water pump flow rate required=150m^3/d÷480min/d=0.31 m^3/min

Head required=8m(Maximum height from bottom of the tank to the effluent oulet)

Designed with 0.4m^3/min×14mH ×3Hp×2 units(inter exchange operation)

6. Sludge Storage Tank:

A. Design parameter:

Designed with sludge quantity=1.5m^3/d

Estimate sludge quantity reduce to 1/2 after storage and thickening ，sludge storage and digest reduce the sludge quantity to 50%

Storage duration > 60 days

Volume required=1.5×1/2×0.5×60=22.5 m^3

B. Plant design:

a. Tank dimensions：

（1）L520×W200×H350/ D325

b. Actual volume

V=33.8 m^3

c. Actual Detention time

DT=33.8÷0.375=90 day