Measured Parameters			mg/L	Ca
	sBODo=		161	50
	CODo=		313.00	
	sCODo=	Si +Ss =	138	44
	rbCODo=	Ss +Sr=	100.0	31
	bCOD/BODo=		1.6	
	VSS%=		85.0%	
	Recirculating rate at average flow		1.00	%
	Chosen MLSS =		3400	mg
Calculated Parameters				
	bCODo=	sbCOD + rbCOD=Ss + Xs + Xp =	514	16
	sCODeff= Si =	sCOD - bCOD =	-119	-38
biodegradab particul C	bpCOD=	Xs + Xp =	257	82
particulate COD	pCOD=	Xs + Xp + Xi=	175	56
	VSS=		299.2	
nonbiodegradable VSS	nbVSS=		-139.2	
	iTSS =	TSS-VSS=	52.8	
	Return sludge concentration, MLSS		6800.0	mg
	rbCOD/bCOD=		0.19	
	Select rbCOD/bCOD=		0.20	

Aeration Tank

Aerobic Sludge Age (t-DS)

$\mu n = (\mu m,n \times NH_{4Neff} / (Kn + N) \times (DO / Ko+DO) - kdn$

Kinetic parameters			K
μm,n , selected	0.75	g VSS/g VSS.d	Di
μm,n,T	0.44	g VSS/g VSS.d	C-
Kn, selected	0.74	g NH_4-N/m^2	
Kn,T	0.49	g NH_4-N/m^3	
kdn, selected	0.08	g VSS/g VSS.d	
kdn,T	0.06	g VSS/g VSS.d	Sp
kd, selected	0.12	g VSS/g VSS.d	Ae
kd,T	0.088	g VSS/g VSS.d	Ae

Sludge Production = Biomass Production (Pxbio) = Xb

Px,bio=((Q x Y x (So-S)) / (1 + kd x SRTa)) + ((fd x kd x Q x Y x (So-S) x SRTa) / (1 + kd x SRTa)) +

Kinetic parameters			S
			μm
Y, selected	0.4	g VSS/g bCOD	
fd, selected	0.15	-	
Yn, selected	0.12	g VSS/g NH4_N	Biologic Sludge
Ks, selected	20.0	g bCOD/m3	X

Kinetic parameters				S
				µm
Y, selected	0.4	g VSS/g bCOD		
fd, selected	0.15	-		
Yn, selected	0.12	g VSS/g NH4_N	Biologic Sludge	
Ks, selected	20.0	g bCOD/m3		X

VSS

nbVSS = (1 - (bpCOD / pCOD))*VSS	nbVSS =	(139.2)	mg
Px,vss=Px,bio + (nbVSS x Q) / 1000	Px,vss =	(636)	kg

TSS

Px,tss=Px,bio / 0.85 + (nbVSS x Q) + Q x (TSSo - VSSo)

Sludge production, Px,tss =	824	kg
MLVSS/MLSS =	(0.771)	

Voxic

Voxic = (Px,tss + Px_{PO4}) x SRTa/ MLSS

Sludge production from Phosphate Precipitation		-	kg
Pxtotal=	Total sludge production	824	kg
	Va=V-oxic =	3,789	m³
	Va= Oxic Volume, selected =	3,789	m³

Nitrogen to be , Nitrified =NN = NOx

NN = NOx = TKNo - (NH4Neff +org Neff)- 0.12 x Pxbio / Q

WASN=	XorgNWAS= 0.12 x Pxbio / Q=	12.9	mg
S-NH_4N = NN =	NOx=Nitrogen to be nitrified=	53.45	mg
		1,086.6	kg

Nitrogen to be Denitrified= NDN = S_NO3,D = DNcapacity

S-$NO_{3,D}$ = NN - NO3Neff = TKNo-TKNeff-WASN +(NO3No-NO3Neff)

	$NO_3Neff_=$	7	mg
DN capacity =	NO3N to be DN=S-$NO_{3,D}$ =	46.5	mg
		944.3	kg

Internal Recirculating Rate, IR

IR = NOx / NO3Neff - 1 - R =		5.64	%
	Selected IR =	5.64	%
NO3N fed into anoxic tank = Q*(Rr+IR)*NO3Neff/1000 =		944.3	kg

Anoxic volume

Selected	Retention time =	0.79	h
	Anoxic volume, required	669	m³
	Anoxic volume, selected	669	m³

F/Mb

Xb = MLVSSbiomass = Q x SRTa / Vaerobic * Y (S_0-S) / (1+ kd x SRTa)

	MLVSSbiomass =Xb=	7,253	mg
F/Mb = (Q x S_0) / (Xb * Vd) =	$F/M_{b=}$	1.344	gB

	Anoxic volume, required	669	m³
	Anoxic volume, selected	669	m³

F/Mb

Xb = MLVSSbiomass = Q x SRTa / Vaerobic * Y (S_0-S) / (1+ kd x SRTa)

	MLVSSbiomass =Xb=	7,253	mg
F/Mb = (Q x S_0) / (Xb * Vd) =	$F/M_{b\,=}$	1.344	gB

Specific Nitrate Removal Rate:

	SDNR at 20 °C (read from Fig. 8- 23)	0.239	(k
	SDNR at T °C = SDNR20*1.026^(Tmin-20)=	0.195	(k

Amount of NitrateN that can be reduced = NOr

NOr = SDNR *Xb *Vd	Nitrate removed =	945.9	kg
Capacity Ratio=	NO3N that can be removed / No3N fed into Anoxic tank=	1.00	>

Aeration Tank Volume

	V-aerobic	3,789	m³
	V-anoxic	669	m³
	V-total	4,458.3	m³
	V-total	4,458.3	m³
	V-anoxic/V-total	0.150	-
F/M ratio		0.430	kgBOD/kgMLSS/d
		5.264	h
	Total sludge age =	18.39	d
	Vtotal=	4,458	m³
	VD/VT=	0.15	
F/M ratio =	kgBOD/kgMLSS/d	0.430	
	tR=	5.3	h
	SRTtotal=	18.4	d
	Tank quantity	2.000	nos.
	Tank volume	2,229	m³
	Water depth	6.000	m
Tank surface, each =		371.523	
Net tank width		9.300	
Diameter of the round parts		9.300	
Middle wall length		33.750	
Total tank length		43.050	

mg/L	Calculated %	Advisable %	dvisable Results
161	50.0%	50%	160.5
313.00			
138	44.0%	30%	93.9
100.0	31.9%	15%	46.95
1.6			
85.0%		85%	
1.00	%	0.75	
3400	mg/lt		
514	164.1%		
-119	-38.0%		
257	82.0%		
175	56.0%		
299.2			
-139.2			
52.8			
6800.0	mg/lt		
0.19			
0.20			

) x (DO / Ko+DO) - kdn

Ko, selected	0.50	mg/L		
Dissolved Oxyg	2.00	mg/L		
C-NH_4,OA= NH	1.00	mg/L		
SF =	2.750	TKNpeak/TKNaverage		SRT %
				<10d
				12
Specific growth rate for nitrifying organisms (μ,I			0.176	> =20
Aerobic sludge age, (t-DS)			15.63	kg/kg*d
Aerobic sludge age, selected			**15.63**	kg/kg*d

: Xb

RTa) / (1 + kd x SRTa)) + (Q x Yn x NOx / (1 + Kdn x SRTa))

S = Ks x (1 + kd x SRT) / (SRT x (μm - kd) -1)			
μm , selected =	6.0	g VSS/g VSS.d	
μm,T =	3.5	g VSS/g VSS.d	
S =	0.91	mg/l	
Biologic Sludge Production=			
Xb = Pxbio =	**2,193**	kg VSS/d	

S = Ks x (1 + kd x SRT) / (SRT x (µm - kd) -1)		
µm , selected =	6.0	g VSS/g VSS.d
µm,T =	3.5	g VSS/g VSS.d
S =	0.91	mg/l
Biologic Sludge Production=		
Xb = Pxbio =	2,193	kg VSS/d

(139.2)	mg/l
(636)	kg/d

824	kg/d
(0.771)	

-	kg/d
824	kg/d
3,789	m³
3,789	m³

12.9	mg/l
53.45	mg/l
1,086.6	kg/d

pacity

NO3Neff)

7	mg/l
46.5	mg/l
944.3	kg/d

5.64	%
5.64	%
944.3	$kgNO_3/d$

$0.011x^3 - 0.085x^2 + 0.305x$

0.79	h
669	m³
669	m³

rbCOD/bCOD	SDNR@20C (power fit)<2	SDNR@20C (ln fit)
10%	0.216	
20%	0.239	
30%	0.261	
40%	0.283	0.300
50%	0.295	

1+ kd x SRTa)

7,253	mg/l
1.344	gBOD/g.d

RUN

669	m³
669	m³

20%	0.239	
30%	0.261	
40%	0.283	0.300
50%	0.295	

RUN

L+ kd x SRTa)

7,253	mg/l
1.344	gBOD/g.d
0.239	$(kgNO_3/d)/kgMLVSS$
0.195	$(kgNO_3/d)/kgMLVSS$
945.9	$kgNO_3/d$
1.00	> 1, OK

m³	
m³	
m³	
m³	
-	
kgBOD/kgMLSS/d	
h	
d	
m³	
h	
d	
nos.	
m^3	
m	

SRT	%of BOD Load
<10d	5.00%
12	4.0%
> =20	3.50%

kg/kg*d

kg/kg*d

305x	
<2	SDNR@20C (ln fit)
.216	
.239	
.261	
.283	0.300
.295	

0.239			
0.261			
0.283	0.300		
0.295			