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APPENDIX A

Phosphorus Measurement with the depth

CD=24 HRT=6					Anaerobic								
14/5/08,	*Port*	*pH*	*Temp.(°C)*	*ORP*	*DO*	*TN*	*TP*	*NH4-N*	*NO3-N*	*NO2-N*	*COD*	*SS*	*VSS*
air 100%,	*eff.*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	70.0	24.0
2.8 L/min	*5 (top)*	6.88	21.4	-44.6	0.32	19.6	12.2	19.8	4.6	0.160	65.00	NA	NA
	4	6.87	21.4	-47.0	0.32	20.8	12.0	20.5	4.6	0.216	50.00	NA	NA
	3	6.95	21.3	-50.9	0.29	20.6	11.8	20.9	3.3	0.112	67.50	NA	NA
	2	7.11	20.9	-70.4	0.25	20.9	11.1	21.1	3.3	0.009	132.50	NA	NA
	1	7.35	20.9	-137.0	0.16	21.7	10.9	21.3	1.0	0.079	215.00	NA	NA
	inf.	6.74	21.6	88.0	0.31	28.0	7.9	24.9	3.4	0.120	330.00	20.0	3.3
Aerobic	*eff.*	7.79	21.0	NA	NA	9.2	1.0	0.5	5.9	NA	22.50	62.0	48.0
	5 (top)	7.99	20.3	229.10	3.1	8.8	0.8	0.5	5.6	0.010	22.50	NA	NA
	4	8.18	20.5	248.00	3.2	10.2	1.0	0.5	5.6	0.003	40.00	NA	NA
	3	7.94	20.5	255.00	3.3	9.5	1.0	0.3	5.9	0.012	45.00	NA	NA
	2	7.9	20.2	260.30	3.5	9.9	1.7	0.3	5.2	0.058	50.00	NA	NA
	1	7.88	20.2	261.80	3.1	8.1	2.7	0.5	6.3	0.043	32.50	NA	NA

CD=24 HRT=4								Anaerobic					
29/5/08	***Port***	***pH***	***Temp.(°C)***	***ORP***	***DO***	***TN***	***TP***	***NH4-N***	***NO3-N***	***NO2-N***	***COD***	***SS***	***VSS***
air 100%	*eff.*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	20.0	16.0
3.0 L/min	*5 (top)*	7.11	23.0	-42.1	0.21	24.4	9.8	22.5	1.6	0.002	137.50	NA	NA
	4	7.04	23.2	-99.9	0.19	24.2	9.5	23.0	1.3	0.001	142.50	NA	NA
	3	7.05	23.1	-120.0	0.14	24.9	9.4	23.2	2.2	0.005	215.00	NA	NA
	2	7.03	23.5	-139.1	0.13	24.6	9.0	23.5	2.5	ur	230.00	NA	NA
	1	6.96	23.3	-156.2	0.13	23.2	8.5	24.2	3.2	0.012	245.00	NA	NA
	inf.	7.02	22.9	35.0	0.28	28.3	8.0	23.2	3.0	0.002	332.50	25.0	3.3
Aerobic	*eff.*	7.91	22.7	NA	NA	15.5	3.9	0.6	7.7	NA	12.50	8.0	8.0
	5 (top)	7.88	22.6	229.10	3.2	14.6	4.1	0.8	7.6	0.017	15.00	NA	NA
	4	7.89	22.3	248.00	3.3	15.9	5.0	1.2	7.5	0.011	17.50	NA	NA
	3	7.81	22.3	255.00	3.2	16.5	5.8	1.1	8.9	0.052	30.00	NA	NA
	2	7.79	22.4	260.30	3.1	17.0	5.9	0.9	8.6	0.210	52.50	NA	NA
	1	7.75	22.8	261.80	3.1	19.3	6.5	3.2	8.7	0.190	67.50	NA	NA

CD=12 HRT=6

Anaerobic

18/3/08	*Port*	*pH*	*Temp.(°C)*	*ORP*	*DO*	*TN*	*TP*	*NH4-N*	*NO3-N*	*NO2-N*	*COD*	*SS*	*VSS*
air 100%	*eff.*	7.28	22.1	NA	NA	22.5	12.4	18.6	3.3	NA	65.0	63.3	26.7
3.0 L/min	*5 (top)*	7.45	22.4	-78.50	0.55	23.0	13.4	21.8	2.0	0.006	57.5	NA	NA
	4	7.36	22.2	-81.80	0.50	23.8	15.5	22.7	2.7	0.008	82.5	NA	NA
	3	7.27	21.0	-85.90	0.45	24.2	16.4	21.3	3.0	0.005	107.5	NA	NA
	2	7.28	20.4	-118.50	0.44	24.2	15.9	21.2	4.9	0.005	135.0	NA	NA
	1	7.14	21.0	-120.00	0.44	25.9	14.9	22.4	4.8	0.018	155.0	NA	NA
	inf.	6.77	21.0	136.00	0.90	28.0	8.6	22.0	3.2	0.011	320.0	33.3	6.7

Aerobic

Port	*pH*	*Temp.(°C)*	*ORP*	*DO*	*TN*	*TP*	*NH4-N*	*NO3-N*	*NO2-N*	*COD*	*SS*	*VSS*
eff.	8.00	22.0	NA	NA	15.1	1.8	ur	8.2	NA	12.5	6.7	0.0
5 (top)	8.15	21.7	297.80	4.1	15.1	1.6	0.1	9.6	0.027	15.0	NA	NA
4	8.25	21.1	260.10	3.9	15.7	2.2	ur	10.2	0.042	17.5	NA	NA
3	8.22	20.9	293.00	4.0	16.4	3.0	0.1	7.1	0.022	20.0	NA	NA
2	8.23	21.6	306.10	4.1	16.9	4.3	ur	7.6	0.011	55.0	NA	NA
1	7.86	21.4	311.30	4.1	18.8	6.5	0.4	8.5	0.113	60.0	NA	NA

CD=12 HRT=4

Anaerobic

29/3/08	*Port*	*pH*	*Temp.(°C)*	*ORP*	*DO*	*TN*	*TP*	*NH4-N*	*NO3-N*	*NO2-N*	*COD*	*SS*	*VSS*
air 100%	*eff.*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	28.0	16.0
3.0 L/min	*5 (top)*	7.33	21.1	1.40	0.31	19.3	10.8	17.3	1.2	0.003	82.5	NA	NA
	4	7.30	21.4	-15.50	0.29	23.5	11.1	19.4	1.0	0.006	105.0	NA	NA
	3	7.34	21.4	-82.40	0.29	21.8	10.5	19.4	1.6	0.002	120.0	NA	NA
	2	7.35	20.4	-114.50	0.18	21.1	8.8	19.2	1.6	0.009	147.5	NA	NA
	1	7.19	20.8	-124.30	0.17	20.8	8.2	18.7	1.8	0.012	210.0	NA	NA
	inf.	6.89	20.8	-98.00	0.28	25.4	7.6	19.9	4.1	0.017	339.0	20.0	0.0

Aerobic

	Port	*pH*	*Temp.*	*ORP*	*DO*	*TN*	*TP*	*NH4-N*	*NO3-N*	*NO2-N*	*COD*	*SS*	*VSS*
	eff.	8.14	22.0	NA	NA	13.0	1.4	0.3	9.2	NA	27.5	8.0	0.0
	5 (top)	8.21	21.0	252.80	5.2	13.6	1.4	0.6	6.8	0.300	30.0	NA	NA
	4	8.20	21.0	267.80	5.1	13.0	1.7	ur	9.0	0.011	42.5	NA	NA
	3	8.26	21.3	271.60	5.1	14.5	3.1	ur	9.1	0.014	65.0	NA	NA
	2	8.01	21.7	279.90	5.2	14.5	4.8	0.4	10.8	0.014	67.5	NA	NA
	1	7.59	21.1	285.90	5.2	14.1	5.1	1.5	8.9	0.300	67.5	NA	NA

CD=12 HRT=3				Anaerobic									
9/4/08	***Port***	***pH***	***Temp.(°C)***	***ORP***	***DO***	***TN***	***TP***	***NH4-N***	***NO3-N***	***NO2-N***	***COD***	***SS***	***VSS***
air 100%	*eff.*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	73.3	26.7
3.0 L/min	*5 (top)*	7	21.4	-96.0	0.17	21.9	10.4	21.4	2.8	0.008	100.00	NA	NA
	4	7.06	21.4	-105.0	0.13	23.4	9.6	22.5	3.1	0.006	165.00	NA	NA
	3	7.07	20.8	-105.6	0.13	22.9	9.7	22.7	3.2	0.005	190.00	NA	NA
	2	6.90	21.0	-96.0	0.16	22.9	9.1	22.7	3.0	0.020	197.50	NA	NA
	1	6.97	20.5	-104.1	0.13	24.7	9.3	23.2	3.3	0.025	220.00	NA	NA
	inf.	6.90	20.3	72.9	0.34	25.9	7.8	25.1	3.0	0.006	302.50	20.0	3.3
				Aerobic									
	Port	***pH***	***Temp.***	***ORP***	***DO***	***TN***	***TP***	***NH4-N***	***NO3-N***	***NO2-N***	***COD***	***SS***	***VSS***
	eff.	7.79	20.3	NA	NA	19.1	6.3	1.2	10.6	NA	15.00	25.0	3.3
	5 (top)	7.59	20.3	237.50	3.6	19.5	7.0	3.0	10.6	0.010	5.00	NA	NA
	4	7.6	20.0	220.10	3.6	17.5	8.0	11.3	4.6	0.011	7.50	NA	NA
	3	7.72	20.5	247.30	3.7	19.7	8.5	16.4	2.8	0.028	17.50	NA	NA
	2	7.64	20.5	225.20	3.6	20.2	9.5	19.5	2.2	0.044	150.00	NA	NA
	1	7.58	20.7	212.00	3.5	19.9	9.8	19.9	1.9	0.010	125.00	NA	NA

CD=12 HRT=2

Anaerobic

21/4/08	*Port*	*pH*	*Temp.(°C)*	*ORP*	*DO*	*TN*	*TP*	*NH4-N*	*NO3-N*	*NO2-N*	*COD*	*SS*	*VSS*
air 100%	*eff.*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	70.7	33.3
3.0 L/min	*5 (top)*	7.17	20.7	-104.3	0.23	24.1	11.6	17.9	4.6	0.025	107.50	NA	NA
	4	7.25	21.7	-118.2	0.23	24.2	10.4	18.1	5.6	0.024	142.50	NA	NA
	3	7.15	21.2	-132.2	0.23	24.4	9.6	18.3	6.4	0.022	190.00	NA	NA
	2	6.98	21.2	-128.5	0.21	24.2	10.3	18.0	7.0	0.021	205.00	NA	NA
	1	6.94	21.3	-139.5	0.20	24.2	10.5	18.0	7.2	0.022	240.00	NA	NA
	inf.	6.78	20.3	85.0	0.32	25.1	7.6	19.1	5.9	0.036	330.00	33.3	6.7

Aerobic

Port	*pH*	*Temp.*	*ORP*	*DO*	*TN*	*TP*	*NH4-N*	*NO3-N*	*NO2-N*	*COD*	*SS*	*VSS*
eff.	7.95	22.0	NA	NA	23.0	7.2	5.0	11.0	NA	12.50	22.5	3.3
5 (top)	7.85	21.3	200.8	2.3	22.4	8.0	5.0	10.3	0.200	15.00	NA	NA
4	8.06	22.9	205.4	3.8	23.0	8.2	5.2	10.0	0.200	32.50	NA	NA
3	7.55	21.9	206.4	3.0	16.8	8.3	5.2	9.9	0.200	42.50	NA	NA
2	7.56	22.1	227.0	3.0	22.0	9.0	8.0	12.2	0.200	87.50	NA	NA
1	7.57	21.9	218.5	3.0	21.1	9.1	ur	13.5	0.200	100.00	NA	NA

CD=6 HRT=6

Anaerobic

19/06/08	*Port*	*pH*	*Temp.(°C)*	*ORP*	*DO*	*TN*	*TP*	*NH4-N*	*NO3-N*	*NO2-N*	*COD*	*SS*	*VSS*
air 100%	*eff.*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	14.0	0.0
3.0 L/min	*5 (top)*	7.09	22.8	150.1	1.75	18.5	9.7	3.3	7.6	0.013	35.00	NA	NA
	4	7.05	22.2	115.1	1.10	18.9	9.3	7.2	7.2	0.020	40.00	NA	NA
	3	7.13	22.5	106.8	0.90	17.5	8.6	10.7	5.6	0.129	42.50	NA	NA
	2	7.29	22.5	59.8	0.65	19.7	8.3	15.0	3.3	0.030	90.00	NA	NA
	1	7.37	22.6	-197.4	0.01	25.0	9.2	19.2	2.1	0.081	120.00	NA	NA
	inf.	6.80	23.2	23.0	0.31	27.2	8.4	23.2	3.0	0.023	305.00	25.0	3.3

Aerobic

	Port	*pH*	*Temp.*	*ORP*	*DO*	*TN*	*TP*	*NH4-N*	*NO3-N*	*NO2-N*	*COD*	*SS*	*VSS*
	eff.	8.18	22.6	NA	NA	8.7	1.6	0.2	7.3	NA	2.50	12.0	4.0
	5 (top)	8.23	22.6	202.13	2.7	8.6	1.6	0.2	7.1	0.006	2.50	NA	NA
	4	8.2	22.8	201.30	2.7	8.6	1.2	0.3	7.0	0.183	15.00	NA	NA
	3	8.05	23.0	198.34	2.6	8.2	1.8	0.4	6.1	0.017	17.50	NA	NA
	2	8.02	23.1	203.80	2.7	7.5	2.5	0.4	5.6	0.200	25.00	NA	NA
	1	7.96	23.1	210.89	2.8	6.3	3.2	0.4	5.3	0.018	42.50	NA	NA

CD=6 HRT=4

Anaerobic

3/7/08	*Port*	*pH*	*Temp.(°C)*	*ORP*	*DO*	*TN*	*TP*	*NH4-N*	*NO3-N*	*NO2-N*	*COD*	*SS*	*VSS*
air 100%	*eff.*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	22.5	3.3
3.0 L/min	*5 (top)*	7.41	22.6	-25.6	0.54	21.4	13.4	19.1	1.6	0.024	70.00	NA	NA
	4	7.40	22.6	-42.3	0.44	24.9	13.8	19.8	2.1	0.014	80.00	NA	NA
	3	7.29	22.6	-78.9	0.12	24.0	13.5	19.3	2.4	0.016	95.00	NA	NA
	2	7.15	22.4	-88.9	0.09	27.4	11.7	18.8	2.8	0.022	125.00	NA	NA
	1	6.98	22.6	-120.0	0.05	27.5	10.0	21.5	5.1	0.054	177.50	NA	NA
	inf.	7.17	22.8	25.8	0.35	28.2	8.1	24.2	4.1	0.021	370.00	20.0	0.0

Aerobic

Port	*pH*	*Temp.*	*ORP*	*DO*	*TN*	*TP*	*NH4-N*	*NO3-N*	*NO2-N*	*COD*	*SS*	*VSS*
eff.	7.92	22.9	NA	NA	9.9	1.3	0.4	6.3	NA	20.00	8.0	0.0
5 (top)	7.92	22.8	240.01	3.8	9.3	1.4	0.5	6.1	0.006	22.50	NA	NA
4	8.07	22.6	262.10	4.2	8.7	1.5	ur	6.2	0.003	20.00	NA	NA
3	8.14	22.9	225.91	3.5	9.5	1.3	ur	4.9	0.008	12.50	NA	NA
2	7.97	22.7	249.80	4.0	8.4	1.5	0.2	5.5	0.022	27.50	NA	NA
1	7.75	22.9	237.40	3.4	10.4	3.3	4.1	3.3	0.312	25.00	NA	NA

CD=6 HRT=3

Anaerobic

11/7/08	*Port*	*pH*	*Temp.(°C)*	*ORP*	*DO*	*TN*	*TP*	*NH4-N*	*NO3-N*	*NO2-N*	*COD*	*SS*	*VSS*
air 100%	*eff.*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	33.3	6.7
3.0 L/min	*5 (top)*	7.27	21.8	-64.1	0.11	21.9	13.3	21.4	2.4	0.011	105.00	NA	NA
	4	7.25	21.6	-75.3	0.12	22.7	13.3	19.8	4.2	0.001	110.00	NA	NA
	3	7.20	21.5	-82.0	0.12	23.2	12.5	19.5	4.4	0.002	137.50	NA	NA
	2	7.13	21.4	-122.0	0.11	23.8	10.3	19.9	4.9	0.006	185.00	NA	NA
	1	7.30	21.4	-130.3	0.10	24.6	8.8	18.9	6.3	0.004	235.00	NA	NA
	inf.	6.85	21.5	42.2	0.31	27.8	7.5	19.7	4.1	0.019	352.50	22.5	3.3

Aerobic

Port	*pH*	*Temp.*	*ORP*	*DO*	*TN*	*TP*	*NH4-N*	*NO3-N*	*NO2-N*	*COD*	*SS*	*VSS*
eff.	7.94	21.7	NA	NA	10.2	1.9	ur	7.0	NA	20.00	12.0	4.0
5 (top)	7.92	21.5	226.20	3.0	10.4	1.9	ur	7.2	0.015	22.50	NA	NA
4	8.17	21.5	220.00	3.0	10.4	2.5	ur	6.5	0.043	20.00	NA	NA
3	8.16	21.5	223.24	3.5	11.1	3.3	0.1	5.4	0.145	12.50	NA	NA
2	7.84	21.6	220.00	3.0	11.6	3.7	0.3	7.2	0.300	27.50	NA	NA
1	7.54	21.5	220.00	2.9	12.5	4.0	4.2	6.6	0.067	25.00	NA	NA

CD=3 HRT=3

Anaerobic

31/7/08	*Port*	*pH*	*Temp.(°C)*	*ORP*	*DO*	*TN*	*TP*	*NH4-N*	*NO3-N*	*NO2-N*	*COD*	*SS*	*VSS*
air 100%	*eff.*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8.0	6.0
3.0 L/min	*5 (top)*	7.29	20.0	-70.2	0.18	22.8	11.9	15.1	1.8	0.026	67.50	NA	NA
	4	7.25	19.9	-70.0	0.17	22.9	11.1	17.0	1.5	0.024	70.00	NA	NA
	3	7.24	19.9	-101.5	0.12	23.9	11.0	17.8	1.7	0.012	72.50	NA	NA
	2	7.20	20.1	-122.5	0.07	24.1	8.9	20.0	0.3	0.002	80.00	NA	NA
	1	7.17	20.2	-153.4	0.02	25.1	8.6	20.8	1.7	0.005	112.50	NA	NA
	inf.	6.97	21.5	-31.1	0.20	27.5	8.0	21.9	2.9	0.003	325.00	20.0	0.0

Aerobic

Port	*pH*	*Temp.*	*ORP*	*DO*	*TN*	*TP*	*NH4-N*	*NO3-N*	*NO2-N*	*COD*	*SS*	*VSS*
eff.	7.91	20.5	NA	NA	7.8	1.1	0.3	8.6	NA	10.00	4.0	6.0
5 (top)	7.85	20.7	303.31	3.1	7.7	1.1	0.3	8.7	0.014	10.00	NA	NA
4	7.93	20.5	332.24	3.3	8.0	1.3	0.4	8.5	0.026	15.00	NA	NA
3	8.04	20.4	335.12	3.3	8.9	1.9	0.5	8.1	0.015	15.00	NA	NA
2	7.99	20.1	301.52	3.1	10.5	3.5	1.1	7.8	0.009	30.00	NA	NA
1	7.97	20.5	312.90	3.2	12.1	4.0	3.9	6.0	0.025	40.00	NA	NA

CD=3 HRT=2													
					Anaerobic								
11/8/08	***Port***	***pH***	***Temp.(°C)***	***ORP***	***DO***	***TN***	***TP***	***NH4-N***	***NO3-N***	***NO2-N***	***COD***	***SS***	***VSS***
air 100%	*eff.*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	14.0	3.3
3.0 L/min	*5 (top)*	7.32	21.3	-50.1	0.21	24.0	12.5	17.9	2.2	0.021	117.50	NA	NA
	4	7.25	21.0	-59.2	0.19	24.3	12.3	18.3	1.9	0.022	120.00	NA	NA
	3	7.24	21.2	-87.5	0.15	24.9	11.1	19.1	1.0	0.012	125.00	NA	NA
	2	7.21	21.5	-118.9	0.07	25.9	10.4	21.1	1.2	0.009	140.00	NA	NA
	1	7.13	21.4	-129.1	0.03	26.0	9.6	22.0	1.5	0.004	150.00	NA	NA
	inf.	6.91	21.3	-32.2	0.21	26.9	8.1	23.5	2.4	0.001	325.00	25.0	3.3
					Aerobic								
	Port	***pH***	***Temp.***	***ORP***	***DO***	***TN***	***TP***	***NH4-N***	***NO3-N***	***NO2-N***	***COD***	***SS***	***VSS***
	eff.	8.01	21.0	NA	NA	9.5	1.7	0.5	8.0	NA	35.00	12.0	4.0
	5 (top)	7.93	21.1	325.81	3.2	10.5	1.8	0.7	8.1	0.015	40.00	NA	NA
	4	7.89	21.0	312.24	3.1	11.0	1.9	0.7	7.6	0.021	45.00	NA	NA
	3	7.91	20.7	315.54	3.1	11.5	2.2	1.0	7.9	0.003	45.00	NA	NA
	2	7.88	20.6	311.52	3.1	12.0	4.1	1.5	7.1	0.042	55.00	NA	NA
	1	7.81	21.1	321.47	3.2	12.1	5.3	5.3	5.2	0.032	70.00	NA	NA

Air:Water=0.048

Anaerobic

21/7/08	*Port*	*pH*	*Temp.(°C)*	*ORP*	*DO*	*TN*	*TP*	*NH4-N*	*NO3-N*	*NO2-N*	*COD*	*SS*	*VSS*
air	*eff.*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	14.0	3.3
2.0 L/min	*5 (top)*	7.41	21.3	-41.3	0.25	22.0	12.7	18.4	4.0	0.300	65.00	NA	NA
	4	7.4	21.5	-79.0	0.12	23.4	12.5	19.0	3.5	0.212	67.50	NA	NA
	3	7.40	21.7	-87.9	0.15	24.5	12.1	20.0	1.8	0.258	72.50	NA	NA
	2	7.22	21.5	-154.1	0.07	25.0	10.5	20.1	2.2	0.052	92.50	NA	NA
	1	7.15	21.6	-163.2	0.05	25.1	9.5	20.1	2.6	0.028	140.00	NA	NA
	inf.	6.84	21.5	15.0	0.29	28.1	8.2	21.5	4.2	0.020	322.50	25.0	3.3

Aerobic

Port	*pH*	*Temp.*	*ORP*	*DO*	*TN*	*TP*	*NH4-N*	*NO3-N*	*NO2-N*	*COD*	*SS*	*VSS*
eff.	8.47	21.5	NA	NA	9.3	2.0	0.3	7.9	NA	7.50	12.0	4.0
5 (top)	8.45	21.3	173.70	2.0	9.5	2.2	0.3	7.8	0.041	7.50	NA	NA
4	8.33	21.1	189.90	2.2	9.8	2.9	0.5	7.4	0.210	10.00	NA	NA
3	8.3	21.1	184.23	2.2	10.1	3.6	0.4	7.2	0.026	10.00	NA	NA
2	8.01	21.1	197.24	2.1	10.5	4.1	1.9	6.9	0.018	15.00	NA	NA
1	7.65	20.8	200.80	2.4	10.7	9.2	4.1	5.2	0.300	25.00	NA	NA

Air:Water=0.024

Anaerobic

23/7/08	*Port*	*pH*	*Temp.(°C)*	*ORP*	*DO*	*TN*	*TP*	*NH4-N*	*NO3-N*	*NO2-N*	*COD*	*SS*	*VSS*
air	*eff.*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	33.3	6.7
1.0 L/min	*5 (top)*	7.6	19.1	49.0	0.27	23.9	12.4	17.6	0.2	0.003	107.50	NA	NA
	4	7.55	19.4	-10.3	0.20	24.0	12.5	18.1	1.0	0.002	125.00	NA	NA
	3	7.49	19.3	-113.8	0.11	24.6	12.9	18.6	1.1	0.004	182.50	NA	NA
	2	7.32	19.4	-121.6	0.07	26.0	11.1	22.1	2.1	0.009	192.50	NA	NA
	1	7.22	19.2	-141.3	0.03	27.4	10.0	22.3	2.7	0.011	212.50	NA	NA
	inf.	7.55	20.1	17.1	0.29	28.0	7.6	23.6	3.2	0.025	342.50	20.0	0.0

Aerobic

	Port	*pH*	*Temp.*	*ORP*	*DO*	*TN*	*TP*	*NH4-N*	*NO3-N*	*NO2-N*	*COD*	*SS*	*VSS*
	eff.	7.90	20.0	NA	NA	9.7	2.4	0.1	6.5	NA	57.50	22.5	3.3
	5 (top)	7.86	19.8	131.60	1.3	9.7	2.4	0.1	6.3	0.328	57.50	NA	NA
	4	7.85	20.2	132.00	1.3	9.7	2.5	0.3	6.0	0.300	65.00	NA	NA
	3	7.94	20.1	126.40	1.2	9.8	2.7	0.6	6.0	0.006	65.00	NA	NA
	2	7.85	20.2	128.00	1.2	10.0	2.8	3.5	5.1	0.210	62.50	NA	NA
	1	7.81	20.4	128.20	1.2	10.6	2.8	5.4	2.5	0.008	75.00	NA	NA

COD:N=16					Anaerobic								
2/8/08	*Port*	*pH*	*Temp.(°C)*	*ORP*	*DO*	*TN*	*TP*	*NH4-N*	*NO3-N*	*NO2-N*	*COD*	*SS*	*VSS*
air 100%	*eff.*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8.0	4.0
3.0 L/min	*5 (top)*	7.16	22.1	-75.2	0.18	15.6	11.9	12.6	0.4	0.005	25.00	NA	NA
	4	7.15	22.0	-80.9	0.16	16.4	12.0	12.9	1.2	0.011	27.50	NA	NA
	3	7.12	21.3	-118.6	0.09	17.4	12.4	13.9	0.9	0.025	40.00	NA	NA
	2	7.10	21.5	-118.1	0.08	18.4	11.9	14.8	1.0	0.007	42.50	NA	NA
	1	6.93	21.2	-158.2	0.02	19.1	11.5	14.9	0.3	0.008	50.00	NA	NA
	inf.	6.66	22.1	-99.2	0.17	21.8	7.7	17.0	2.9	0.024	332.50	22.5	3.3
					Aerobic								
	Port	*pH*	*Temp.*	*ORP*	*DO*	*TN*	*TP*	*NH4-N*	*NO3-N*	*NO2-N*	*COD*	*SS*	*VSS*
	eff.	7.75	22.4	NA	NA	6.0	2.6	0.2	5.0	NA	0.00	6.0	6.0
	5 (top)	7.68	22.3	321.90	2.9	6.1	2.6	0.3	5.7	0.009	0.00	NA	NA
	4	7.83	22.1	329.25	3.2	5.8	3.1	0.5	5.2	0.016	5.00	NA	NA
	3	8	22.3	335.40	3.3	5.7	5.1	0.5	5.0	0.007	2.50	NA	NA
	2	7.93	22.2	328.53	3.1	6.0	4.9	1.0	4.9	0.029	5.00	NA	NA
	1	7.91	22.5	329.10	3.0	8.5	6.3	2.9	1.6	0.300	17.50	NA	NA

COD:N=8					Anaerobic								
8/8/08	***Port***	***pH***	***Temp.(°C)***	***ORP***	***DO***	***TN***	***TP***	***NH4-N***	***NO3-N***	***NO2-N***	***COD***	***SS***	***VSS***
air 100%	*eff.*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8.0	6.0
3.0 L/min	*5 (top)*	7.24	22.6	-29.1	0.40	31.2	15.1	29.0	2.1	0.022	30.00	NA	NA
	4	7.2	22.5	-35.9	0.35	31.9	15.0	31.0	1.0	0.012	47.50	NA	NA
	3	7.19	22.3	-125.1	0.14	34.4	14.0	31.3	1.3	0.006	52.50	NA	NA
	42	7.14	22.3	-132.5	0.09	35.6	12.5	32.7	0.3	0.005	120.00	NA	NA
	1	6.90	22.7	-151.7	0.01	39.9	9.9	34.4	0.8	0.011	177.50	NA	NA
	inf.	6.67	22.5	-100.7	0.17	43.0	7.5	36.9	2.8	0.046	345.00	20.0	0.0
					Aerobic								
	Port	***pH***	***Temp.***	***ORP***	***DO***	***TN***	***TP***	***NH4-N***	***NO3-N***	***NO2-N***	***COD***	***SS***	***VSS***
	eff.	8.10	22.7	NA	NA	17.2	1.1	0.2	13.0	NA	0.00	4.0	6.0
	5 (top)	8	22.6	292.56	2.8	17.1	1.1	0.2	12.9	0.120	0.00	NA	NA
	4	7.95	21.9	322.11	3.3	17.4	1.1	0.4	12.5	0.130	0.00	NA	NA
	3	7.9	22.0	320.91	3.0	17.4	1.2	0.6	12.5	0.300	0.00	NA	NA
	2	7.9	22.1	310.68	3.2	17.8	1.3	1.0	10.4	0.214	5.00	NA	NA
	1	7.89	21.6	321.57	3.2	18.0	1.4	9.5	5.1	0.300	5.00	NA	NA

COD:P=60

Anaerobic

16/8/08	*Port*	*pH*	*Temp.(°C)*	*ORP*	*DO*	*TN*	*TP*	*NH4-N*	*NO3-N*	*NO2-N*	*COD*	*SS*	*VSS*
air 100%	*eff.*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	33.3	6.7
3.0 L/min	*5 (top)*	7.25	24.7	-41.5	0.20	23.2	18.0	25.0	3.4	0.059	60.00	NA	NA
	4	7.14	24.5	-72.0	0.15	25.0	17.5	25.0	1.1	0.015	77.50	NA	NA
	3	7.02	24.8	-94.6	0.09	25.2	17.0	25.4	0.8	0.005	120.00	NA	NA
	2	6.95	24.3	-113.5	0.02	25.9	15.0	26.9	1.1	0.029	180.00	NA	NA
	1	6.88	25.0	-139.1	0.01	27.3	13.2	27.4	0.5	0.009	215.00	NA	NA
	inf.	6.82	24.7	-13.7	0.20	28.5	8.0	28.0	2.8	0.012	455.00	20.0	0.0

Aerobic

Port	*pH*	*Temp.*	*ORP*	*DO*	*TN*	*TP*	*NH4-N*	*NO3-N*	*NO2-N*	*COD*	*SS*	*VSS*
eff.	7.97	24.7	NA	NA	12.5	0.6	0.1	9.1	NA	0.00	22.5	3.3
5 (top)	7.95	24.5	355.91	3.7	12.7	0.6	0.1	9.2	0.017	0.00	NA	NA
4	7.81	24.0	323.27	3.5	12.0	0.8	0.9	8.7	0.053	5.00	NA	NA
3	7.74	23.4	320.40	3.3	10.4	1.0	5.4	8.9	0.300	12.50	NA	NA
2	7.58	24.0	324.06	3.3	13.9	4.1	9.2	8.8	0.190	20.00	NA	NA
1	7.33	24.1	300.74	2.8	15.2	6.5	13.4	8.4	0.196	32.50	NA	NA

COD:P=30

Anaerobic

22/8/08	*Port*	*pH*	*Temp.(°C)*	*ORP*	*DO*	*TN*	*TP*	*NH4-N*	*NO3-N*	*NO2-N*	*COD*	*SS*	*VSS*
air 100%	*eff.*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	14.0	3.3
3.0 L/min	*5 (top)*	7.12	24.5	45.1	0.39	24.0	19.2	22.8	4.2	0.036	25.00	NA	NA
	4	7.1	22.9	-73.1	0.11	24.9	18.9	23.1	3.0	0.012	32.50	NA	NA
	3	6.99	23.2	-71.9	0.07	25.1	19.0	23.9	1.8	0.026	42.50	NA	NA
	2	7.07	23.1	-93.1	0.05	25.8	18.3	24.1	0.8	0.019	72.50	NA	NA
	1	7.05	23.2	-101.0	0.05	27.2	15.6	24.4	0.8	0.023	95.00	NA	NA
	inf.	7.00	22.9	-32.7	0.20	28.5	8.7	25.1	2.0	0.024	230.00	25.0	3.3

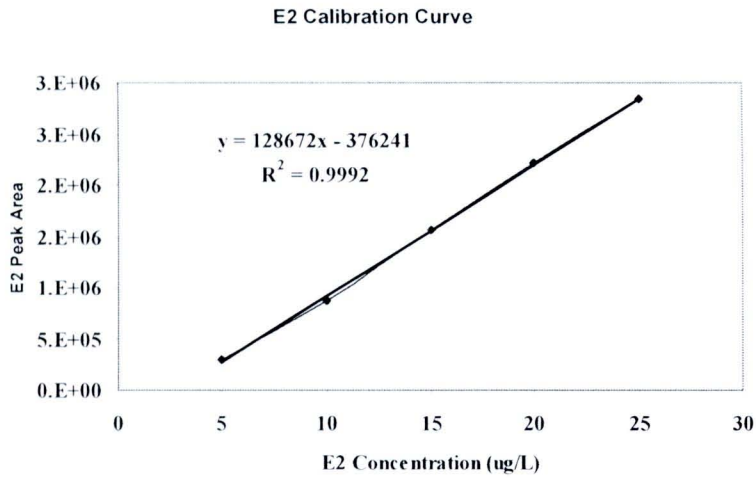
Aerobic

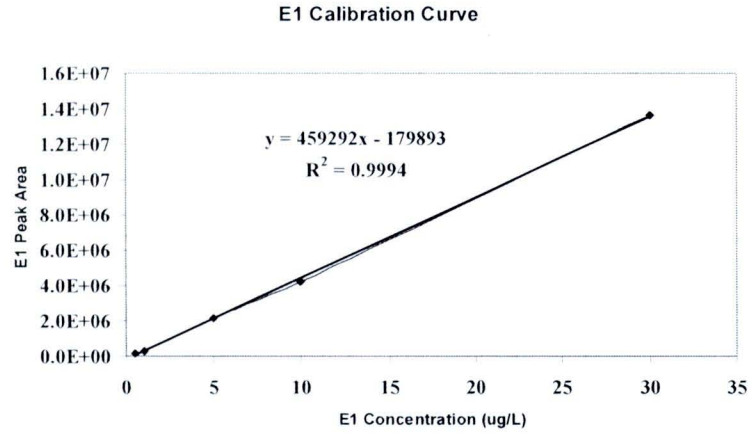
Port	*pH*	*Temp.*	*ORP*	*DO*	*TN*	*TP*	*NH4-N*	*NO3-N*	*NO2-N*	*COD*	*SS*	*VSS*
eff.	7.45	24.3	NA	NA	15.3	0.3	0.0	11.8	NA	0.00	12.0	4.0
5 (top)	7.47	24.3	342.48	3.5	15.1	0.3	0.2	11.7	0.005	0.00	NA	NA
4	7.5	24.1	321.39	3.1	14.9	0.5	3.5	10.6	0.001	2.50	NA	NA
3	7.53	24.6	279.55	2.5	13.6	0.8	7.5	10.8	0.018	7.50	NA	NA
2	7.5	24.9	200.53	1.9	15.5	3.5	7.9	10.4	0.023	12.50	NA	NA
1	7.45	24.8	125.81	1.0	17.5	4.2	14.3	10.1	0.021	17.50	NA	NA

APPENDIX B

E2 and E1 calibration curve

Calibration curves for E2 and E1 were prepared by plotting the response peak area of E2 and E1versus the E2 and E1 standard concentrations (see below). The limits of the detection (LOD) for E2 was 3 ug/L and E1 was 3 ug/L.





Adsorption isotherm data

C_0(ug/L)	10	50	250	500	1000
$C_{aq}^{ads}{}_{(eq)}$ (ppb)	4.95	22.53	144.97	370.59	847.61
$C_s^{ads}{}_{(eq)}$ (ug/g)	16.83	91.57	350.1	431.37	507.97
$\log C_{aq}^{ads}{}_{(eq)}$ (ppb)	0.694605	1.352761	2.161278	2.568894	2.928196
$\log C_s^{ads}{}_{(eq)}$ (ug/g)	1.226084	1.961753	2.544192	2.63485	2.705838

APPENDIX C

The impact of operating parameters to E2 removal efficiency.

HRT=6	E2	E1	**HRT=4**	E2	E1	**HRT=3**	E2	E1
Influent	89.19	4.05	Influent	111.7647	3.275	Influent	98.94706	3.09
1	14.07	78.192	1	79.19412	6.975	1	81.51765	10.235
3	6.09	65.452	3	51.70588	81.815	3	65	67.5475
5	4.84	42.448	5	34.06471	70.025	5	48.27647	50.945
6	4.69	2.99	6	4.84	7.83	6	43.48	12.78
8	4.77	0.22	8	3.65	0.43	8	5.17	1.13
Effluent	4.59	0.24	Effluent	3.44	0.47	Effluent	4.38	0.55

Air:Water 0.072	E2	E1	NO3-N	**Air:Water 0.048**	E2	E1	NO3-N	**Air:Water 0.024**	E2	E1	NO3-N
Influent	121.13	3.89	2.9	Influent	80.16	5.11	4.2	Influent	91.39	4.02	3.2
1	88.48	43.28	1.7	1	51.98	76.03	2.6	1	74.92	43.92	2.7
3	64.76	34.94	1.7	3	30.88	70.45	1.8	3	54.75	45.13	1.1
5	27.53	33.05	1.8	5	23.25	35.32	4	5	21.82	27.88	0.2
6	10.36	8.95	6	6	16.2	0.65	5.2	6	4.88	16.82	2.5
8	2.91	0.59	8.1	8	4.39	0.26	7.2	8	4.46	12.79	6
Effluent	2.69	0.57	8.6	Effluent	4.15	2.75	7.9	Effluent	4.01	12.01	6.5

C/N=16	E2	E1	NO3-N	**C/N=12**	E2	E1	NO3-N	**C/N=8**	E2	E1	NO3-N
Influent	104.46	9.84	2.9	Influent	121.13	3.89	2.9	Influent	110.475	2.93	2.8
1	57.81	90.02	0.3	1	88.48	43.28	1.7	1	66.47	63.29	0.8
3	33.51	73.68	0.9	3	64.76	34.94	1.7	3	29.03	51.38	1.3
5	22.34	48.82	0.4	5	27.53	33.05	1.8	5	10.62	45.06	2.1
6	3.8	1.19	1.6	6	10.36	8.95	6	6	2.305	1.105	5.1
8	2.94	0.23	5	8	2.91	0.59	8.1	8	1.975	0.17	12.5
Effluent	3.48	0.46	5	Effluent	2.69	0.57	8.6	Effluent	1.63	0.125	13

BIOGRAPHY

Mr Sutthipong Lapanunt was born in Chonburi, Thailand in 1983. He received his Bachelor of Science degree in Environmental Science from Kasetsart University in 2006. His bachelor's degree project was entitled "Preparation of Coagulant from Sludge for Oil and Grease Treatment". The project was financially supported by Industrial and Research Projects for Undergraduate Students (IRPUS), Thailand Research Fund (TRF). It was an early research work of his life.

Soon after, he graduated with a Master's degree from the International Postgraduate Programs in Master degree in Environmental Management, Chulalongkorn University. He conducted his thesis experiments as a visiting scholar for a year at the Department of Civil, Construction and Environmental Engineering, Iowa State University, Iowa, USA. No obstacle was too great for him to overcome. He hopes this principle will keep continuing for the rest of his life and he also wishes his accomplishments would not end here.

His research interests have focused on physical, chemical, and biological treatment systems for hazardous waste and municipal and industrial wastewaters. His interests also include waste treatment plants development and recovery of valuable byproduct and energy byproducts such as methane and hydrogen.