APPENDIX A

Maps

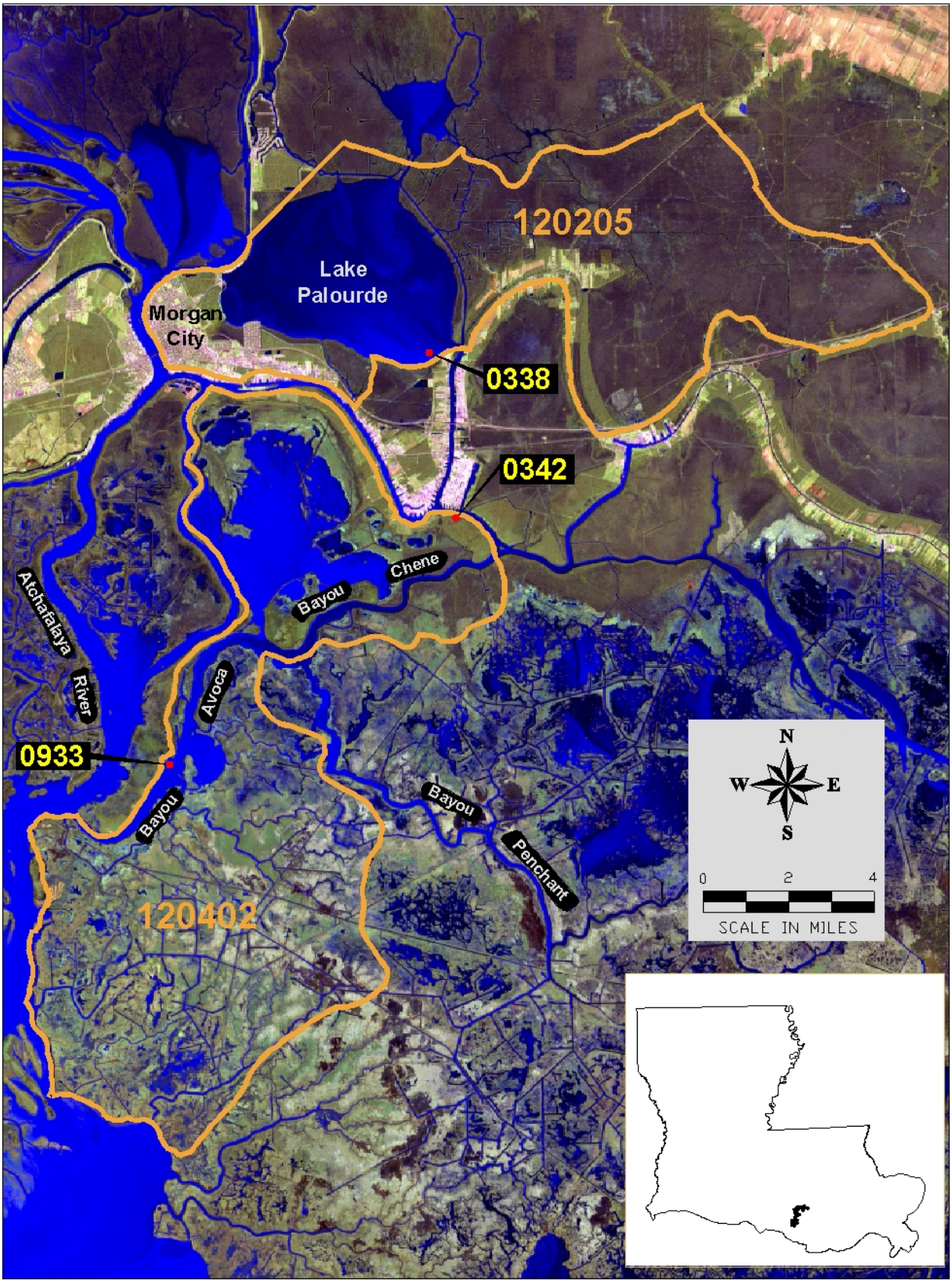


Figure A.1. Water quality survey stations.

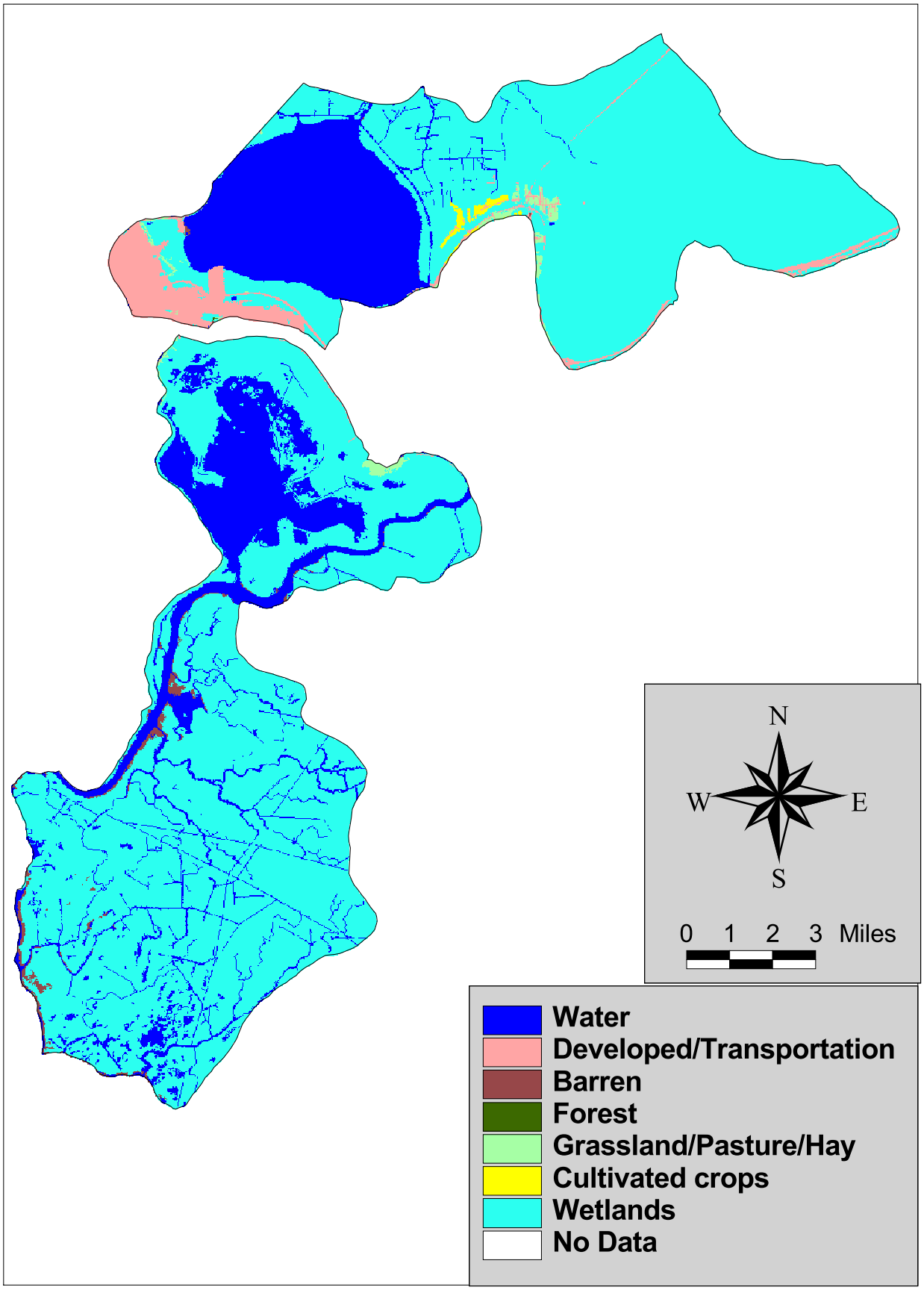


Figure A.2. Land use for pH impaired subsegments.

APPENDIX B

Point Source/Permitted Facilities

Table B.1. Summary of NPDES Permits in Subsegments 120205 and 120402.

Permit Number	Facility Name	Permit Type/Facility Type	Receiving Stream	Subsegment Location	City	Flow Rate (gpd)	Flow Rate Type	pH		Included in Model?	Included in TMDL?
								Minimum	Maximum		
LAG540151	World-Wide Environmental Solutions LLC - Greenleaf Park Subdivision	Gen-LAG54-Sanitary Class II	BAYOU L'OURSE-BAYOU BOEUF	120205	Morgan City	25,000	max permit flow	6	9	No	Yes
LAG540162	World-Wide Environmental Solutions LLC - Wildwood Subdivision	Gen-LAG54-Sanitary Class II	BAYOU BOEUF	120205	Morgan City	25,000	max permit flow	6	9	No	Yes
LAR041028	Morgan City of - Municipal Separate Storm Sewer System	Gen-LAR04-Small MS4 (10,001-50,000)			Morgan City					Yes	Yes
LAR05M026	LA Energy & Power Authority - LEPA Morgan City Steam Power Plt	Gen-LAR05-Multi-Sector			Morgan City					No	No
LAR05M067	Tuboscope/A Barco Co	Gen-LAR05-Multi-Sector			Morgan City					No	No
LAR05M295	Patterson Tubular Services Inc	Gen-LAR05-Multi-Sector			Morgan City					No	No
LAR05M443	Stephens Shipyard Inc	Gen-LAR05-Multi-Sector			Morgan City					No	No
LAR05N154	Energy Logistics Inc Morgan City Shorebase	Gen-LAR05-Multi-Sector			Morgan City					No	No
LAR05N169	Halliburton Energy Services Inc	Gen-LAR05-Multi-Sector			Morgan City					No	No
LAR05N382	Tuboscope/A Barco Co	Gen-LAR05-Multi-Sector			Morgan City					No	No
LAR05N556	Halimar Shipyard LLC	Gen-LAR05-Multi-Sector			Morgan City					No	No
LAR05N706	Central Boat Rentals Inc	Gen-LAR05-Multi-Sector			Morgan City					No	No
LAR10B128	Morgan City/Berwick Floodproofing	Gen-LAR10-Construction			Morgan City					No	No
LAG33A380	Lake Palourde Norman Production Facility - Lake Palourde Field	Gen-LAG33-Coastal	Lake Palourde	120205	Amelia					No	No
LAG33A446	State Lease 17599 Well #1 Facility - Simon Pass Field	Gen-LAG33-Coastal	Lake Palourde	120205						No	No

Permit Number	Facility Name	Permit Type/Facility Type	Receiving Stream	Subsegment Location	City	Flow Rate (gpd)	Flow Rate Type	pH		Included in Model?	Included in TMDL?
								Minimum	Maximum		
LAG480258	PHI Inc	Gen-LAG48-Light Commercial	local drainage to Bayou Palourde	120205	Amelia	variable		6	9	No	No
LAG480415	American Vacuum	Gen-LAG48-Light Commercial	local drainage to Ramos Bayou to Lake Palourde	120205	Morgan City	120	expected	6	9	No	No
LAG531153	Terrebonne Parish Recreation District #8 - Donner Community Center	Gen-LAG53-Sanitary Class I	unnamed ditch to Bayou Blue	120205	Donner	2,000	design capacity	6	9	No	Yes
LAG570055	St Mary Parish District #1 - Siracusa Subdivision STP	Gen-LAG57-Sanitary Class IV	Ramos Bayou	120205	Morgan City	90,000	expected	6	9	No	Yes
LAG750480	Mikes Car Wash LLC	Gen-LAG75-Exterior Vehicle Wash	storm drainage to Laek Palourde	120205	Morgan City			6	9	No	No
LA0033006	AMELIA OXID POND,ST MARY PH SEWER DIST #4	3-CELL OXIDATION POND	LAKE PALOURDE	120205		65,000	average			No	Yes
LA0102491	MORGAN CITY BASE,PETROLEUM HELICOPTERS INC	HELICOPTER BASE	LAKE PALOURDE	120205				6	9	No	No
						intermittent		6	9	No	No
LAG540523	BAYOU SIDE MOBILE HOME PARK,BAYOUSIDE TRAILER PARK	TRAILER PARK	BAYOU L'OURSE-LAKE PALOURDE	120205				6	9	No	Yes
LAG560173	,HOTARDS BAYOUSIDE MHP	MHP	BAYOU L'OURSE	120205		50,000	max permit flow	6	9	No	Yes

FILE: R:\PROJECTS\2110-622\TECH\NPDES\FINAL_CHENE_&_PALOURDE_NPDES_4-10-07.XLS

Table B.1. Permit Summary

APPENDIX C

Historical Data Plots

Figure C.1. Observed pH in Lake Palourde near Morgan City (LDEQ 0338)

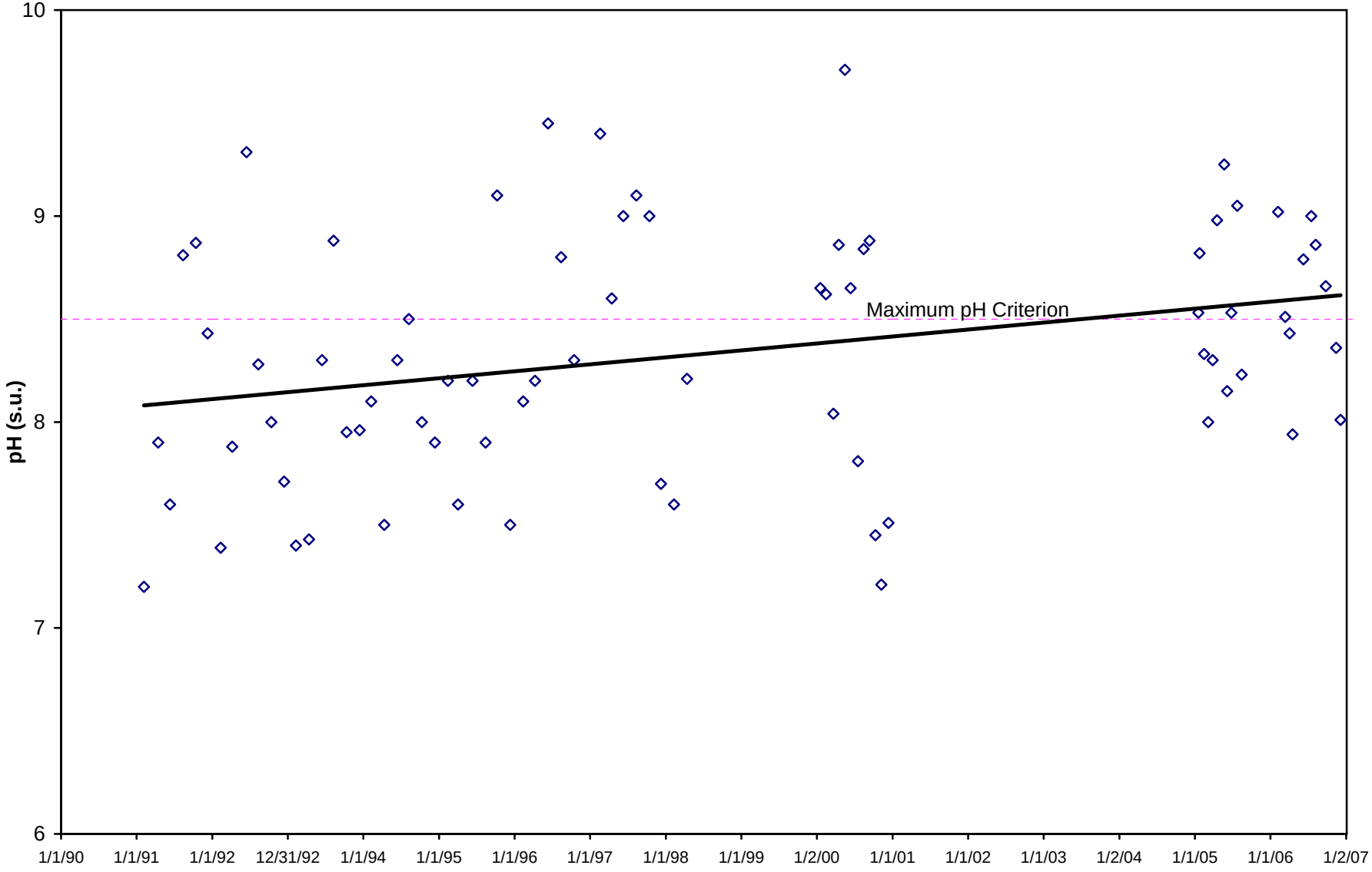


Figure C.2. Seasonal pH in Lake Palourde near Morgan City, LA (LDEQ 0338)

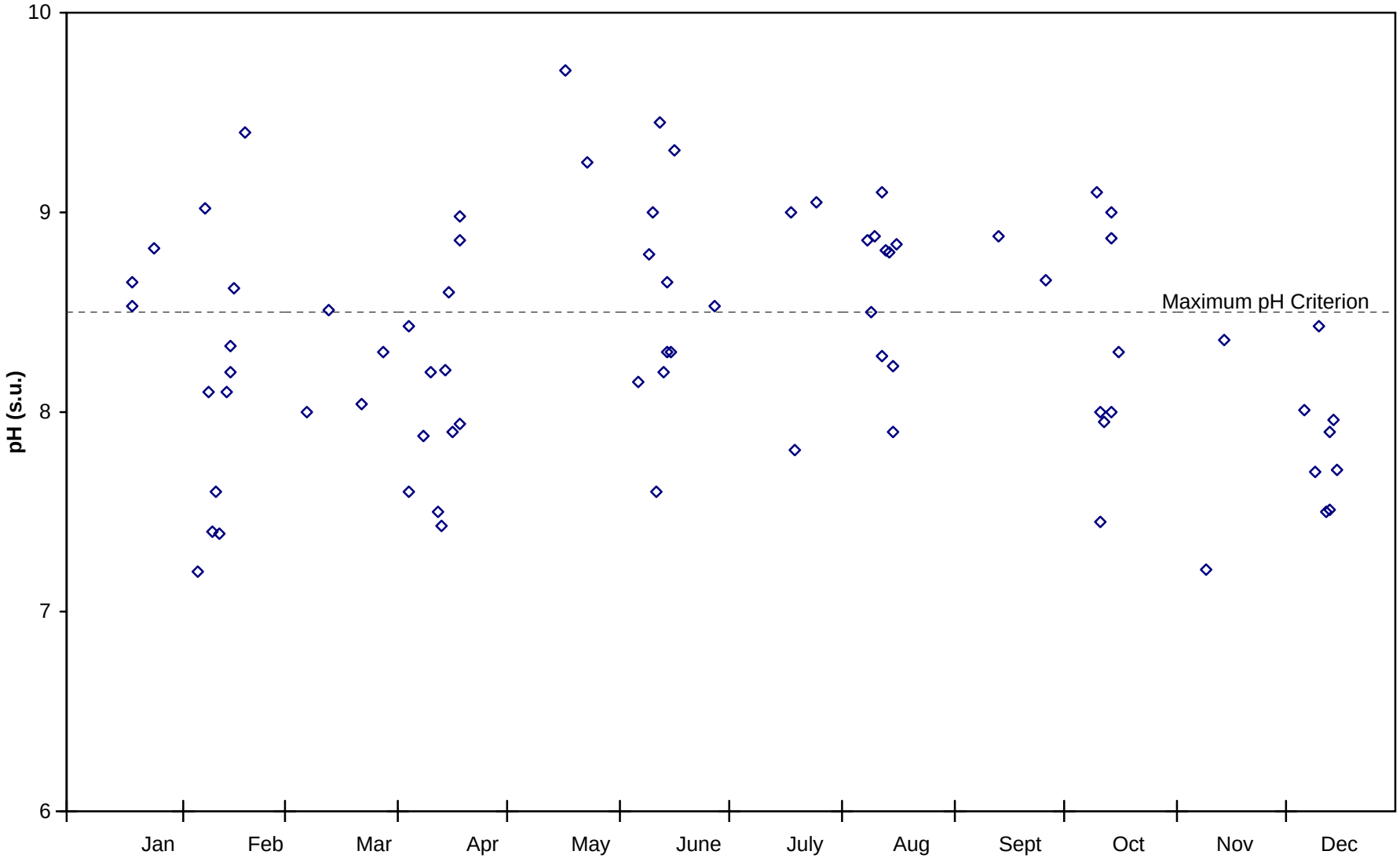


Figure C.3. Observed pH for Bayou Chene southeast of Morgan City (LDEQ 0342)

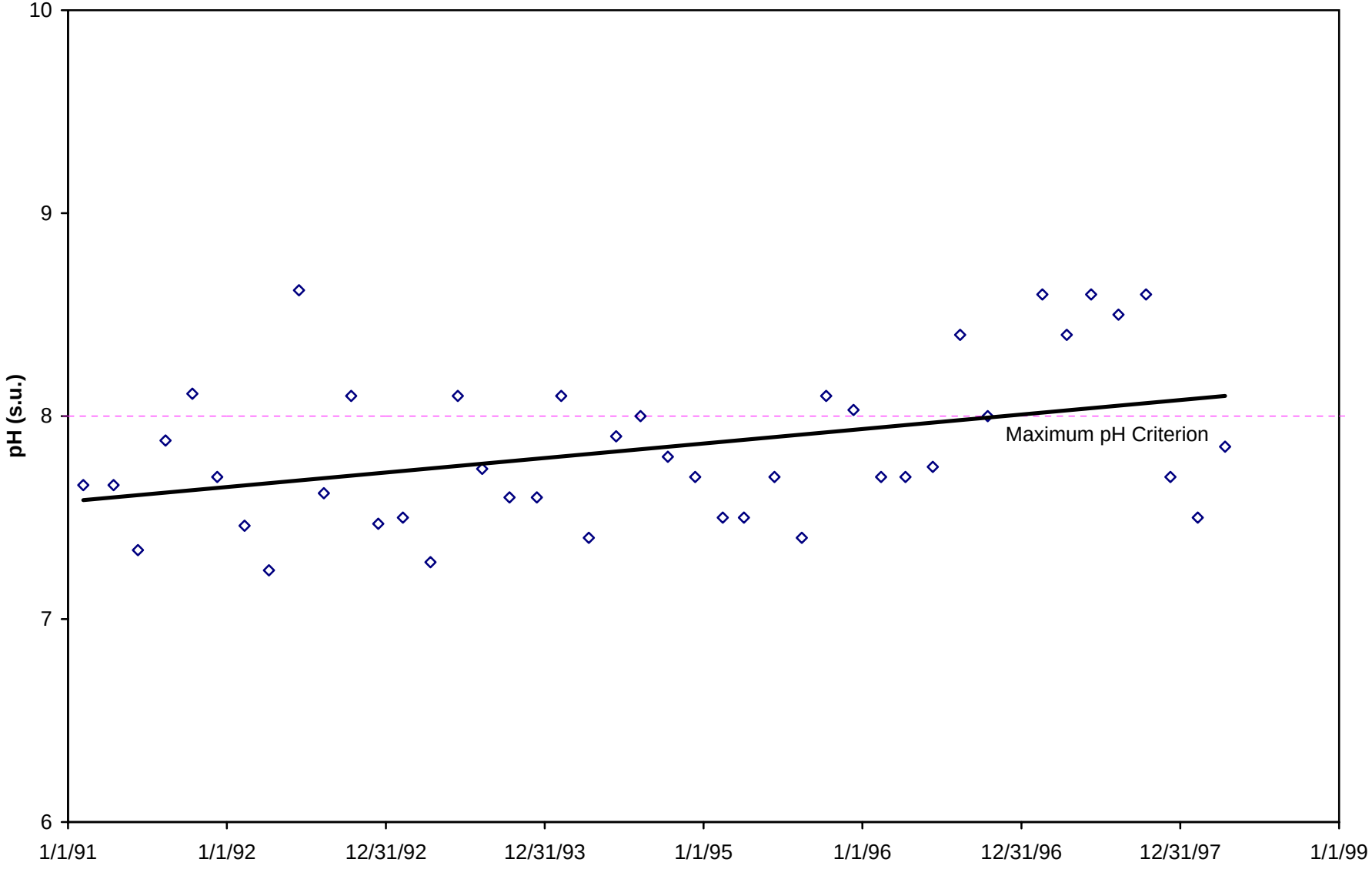


Figure C.4. Seasonal pH for Bayou Chene southeast of Morgan City (LDEQ 0342)

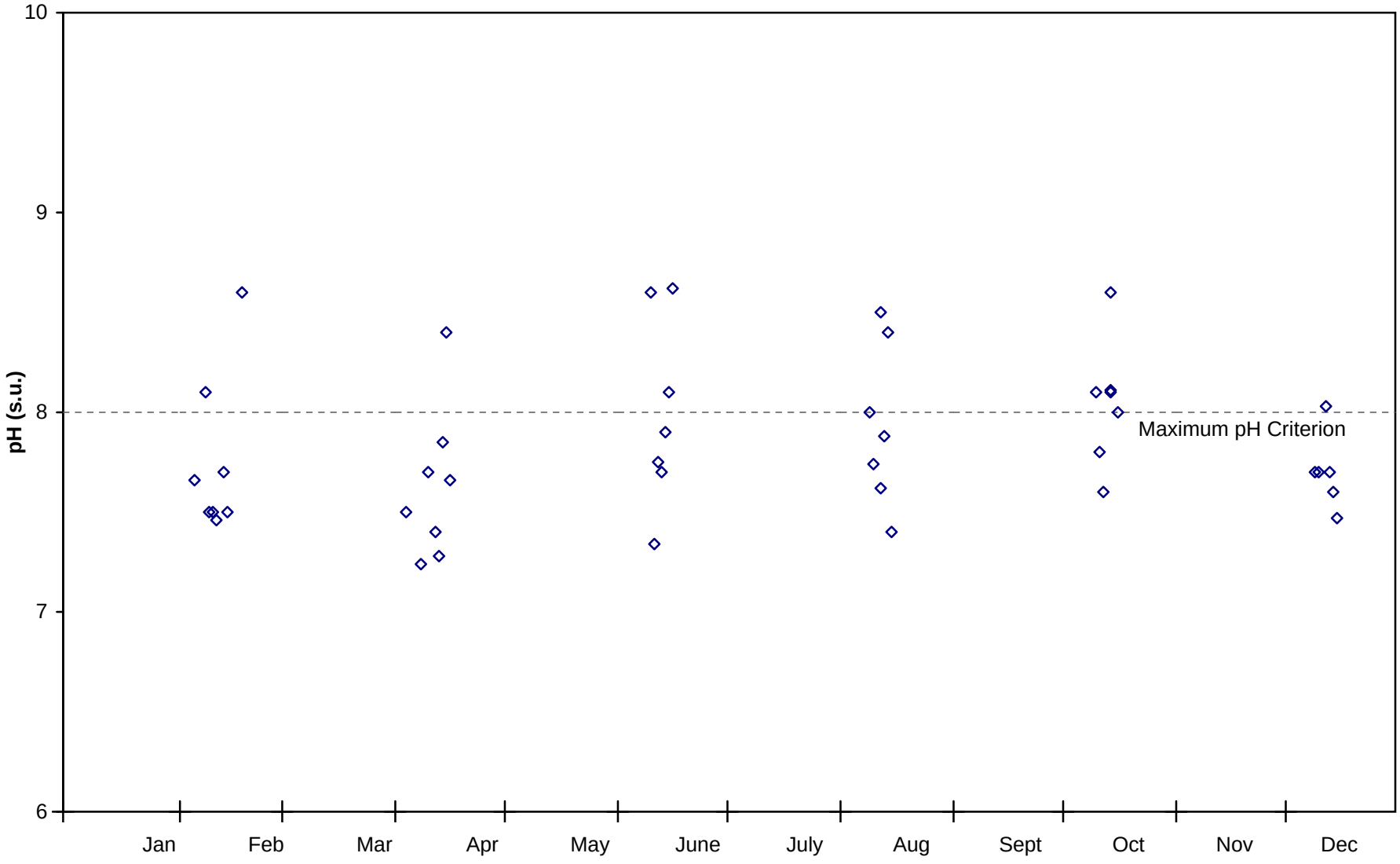


Figure C.5. Observed pH for Bayou Avoca at Sword Bayou (LDEQ 0933)

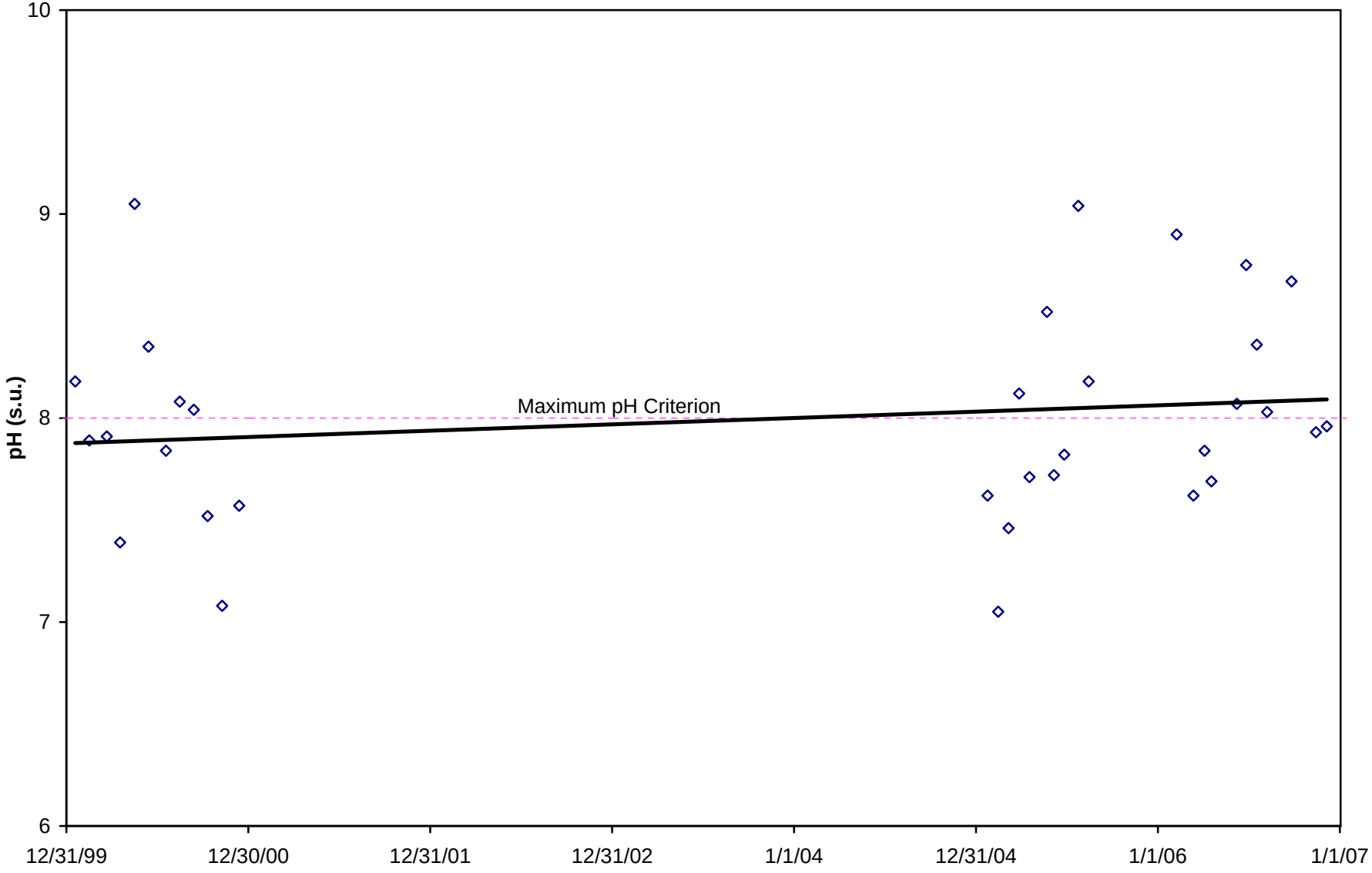


Figure C.6. Seasonal pH for Bayou Avoca at Sword Bayou (LDEQ 0933)

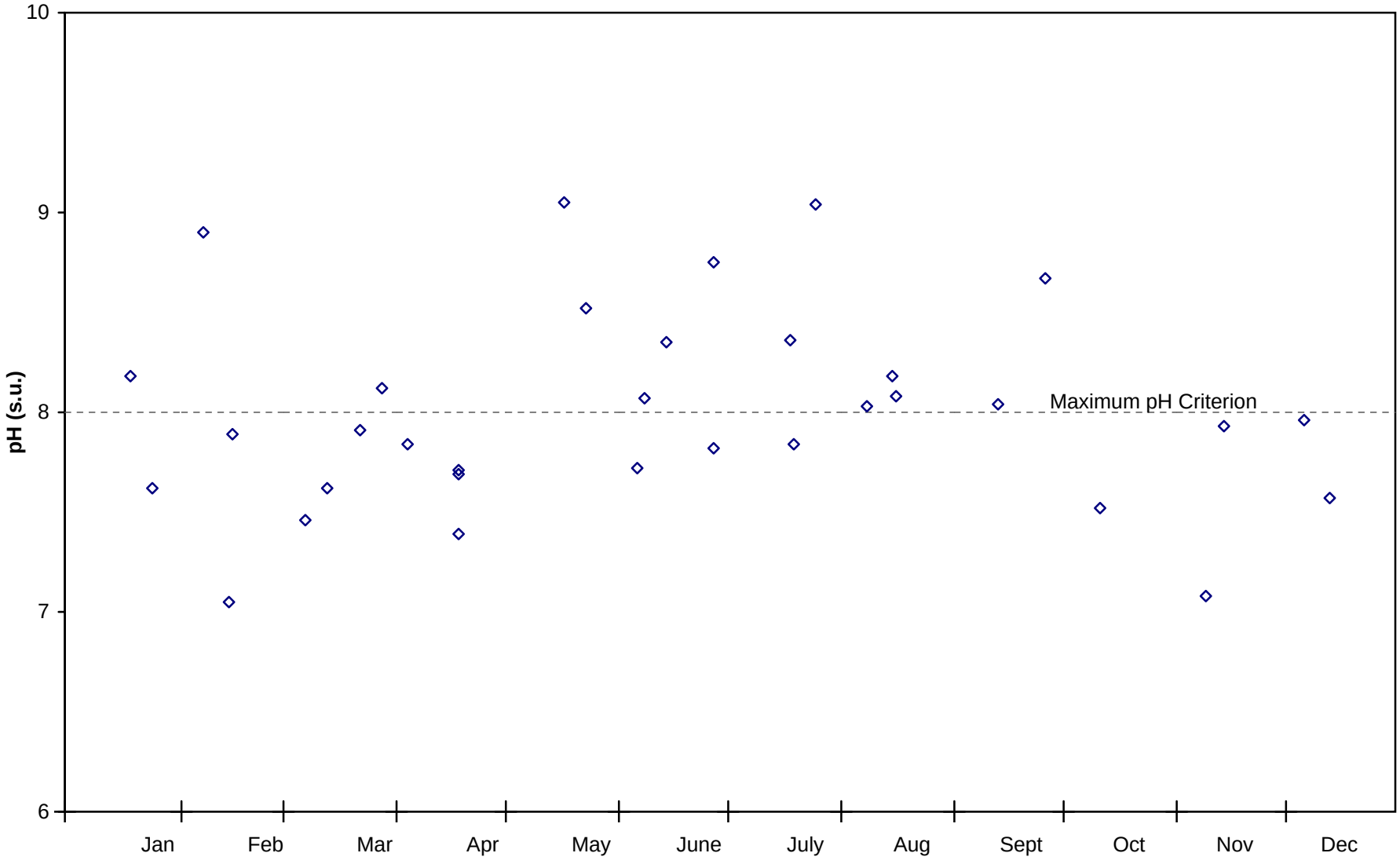


Figure C.7. Observed Alkalinity in Lake Palourde near Morgan City (LDEQ 0338)

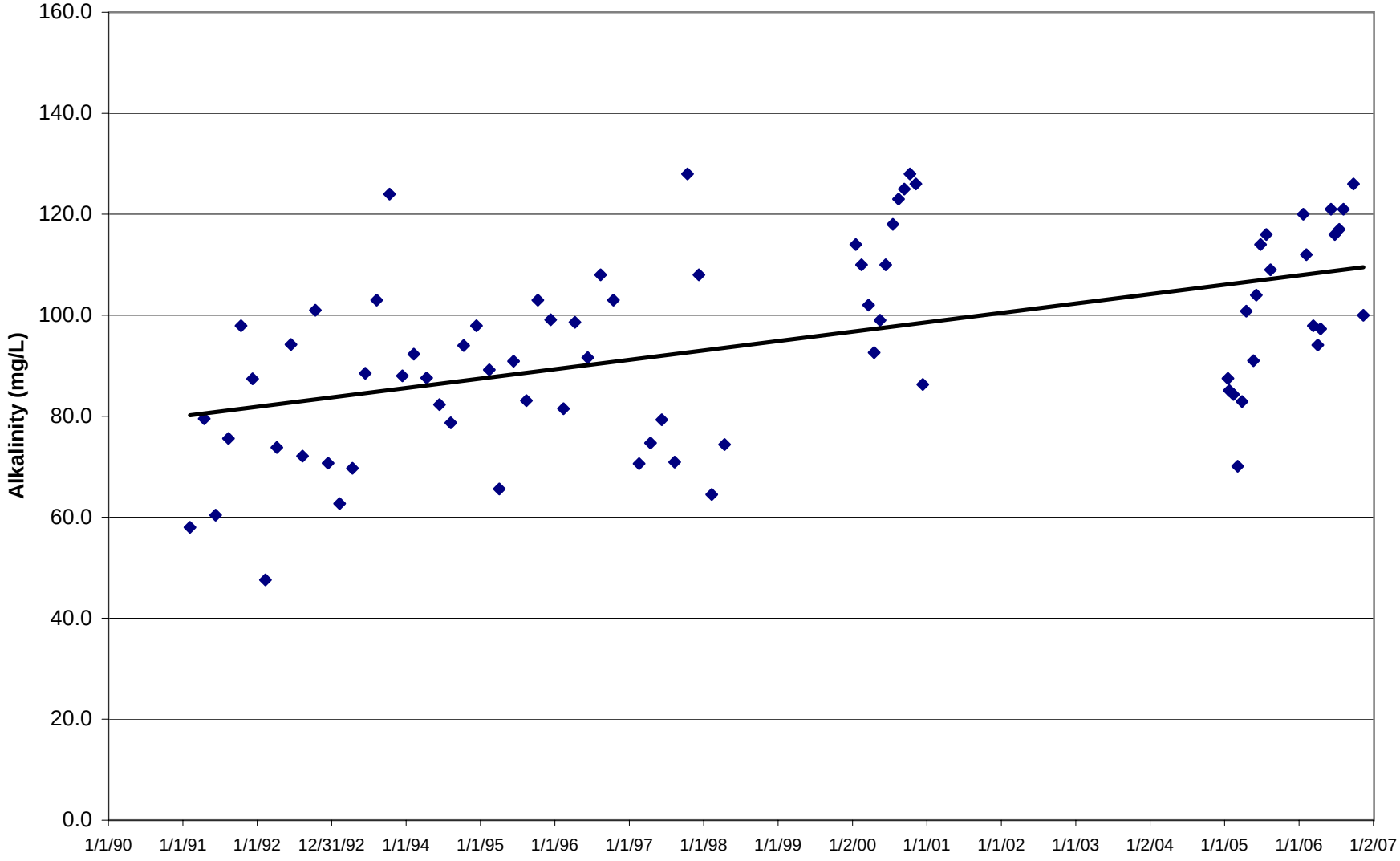


Figure C.8. Observed Alkalinity in Bayou Chene southeast of Morgan City (LDEQ 0342)

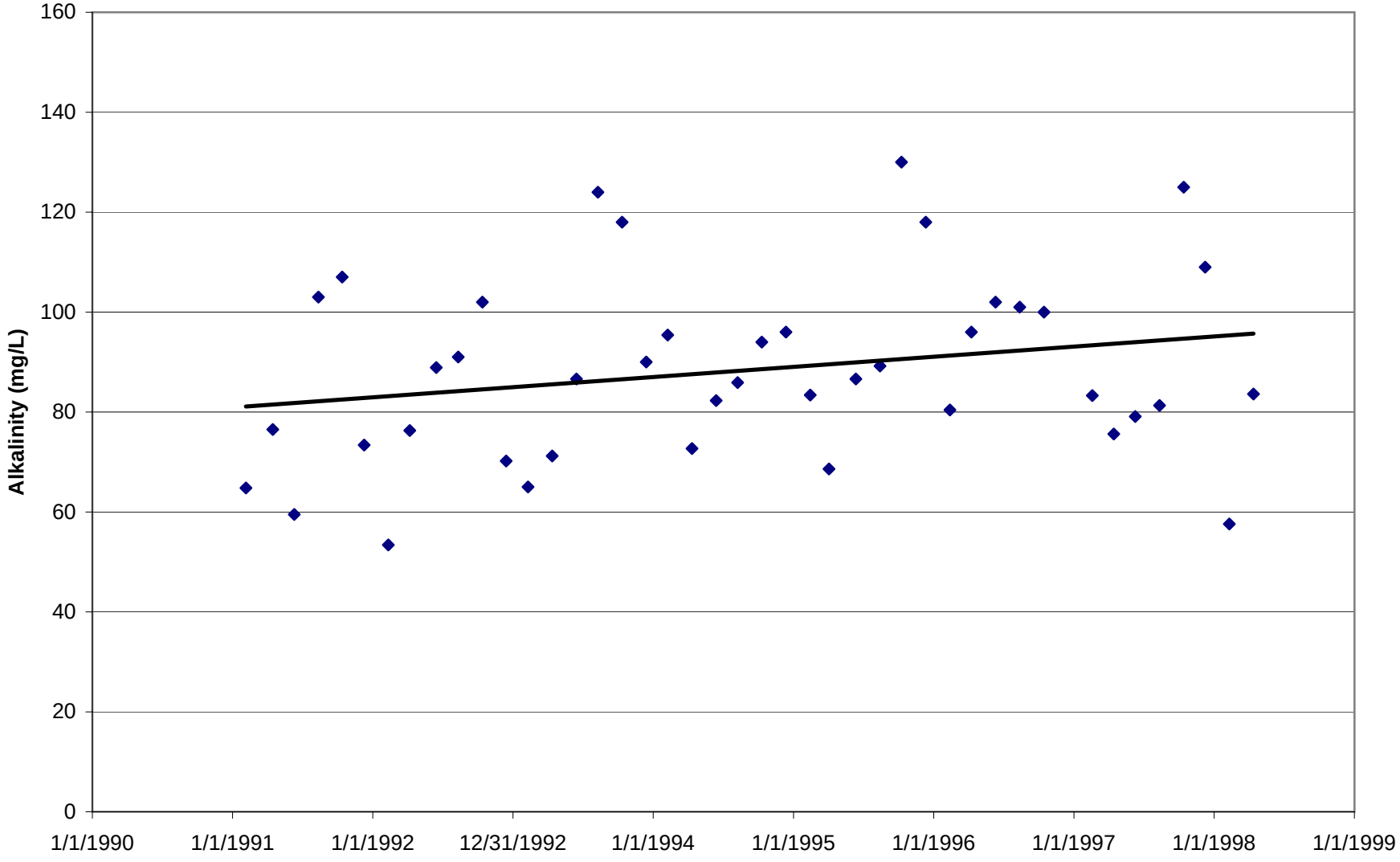


Figure C.9. Observed Alkalinity in Bayou Avoca at Sword Bayou (LDEQ 0933)

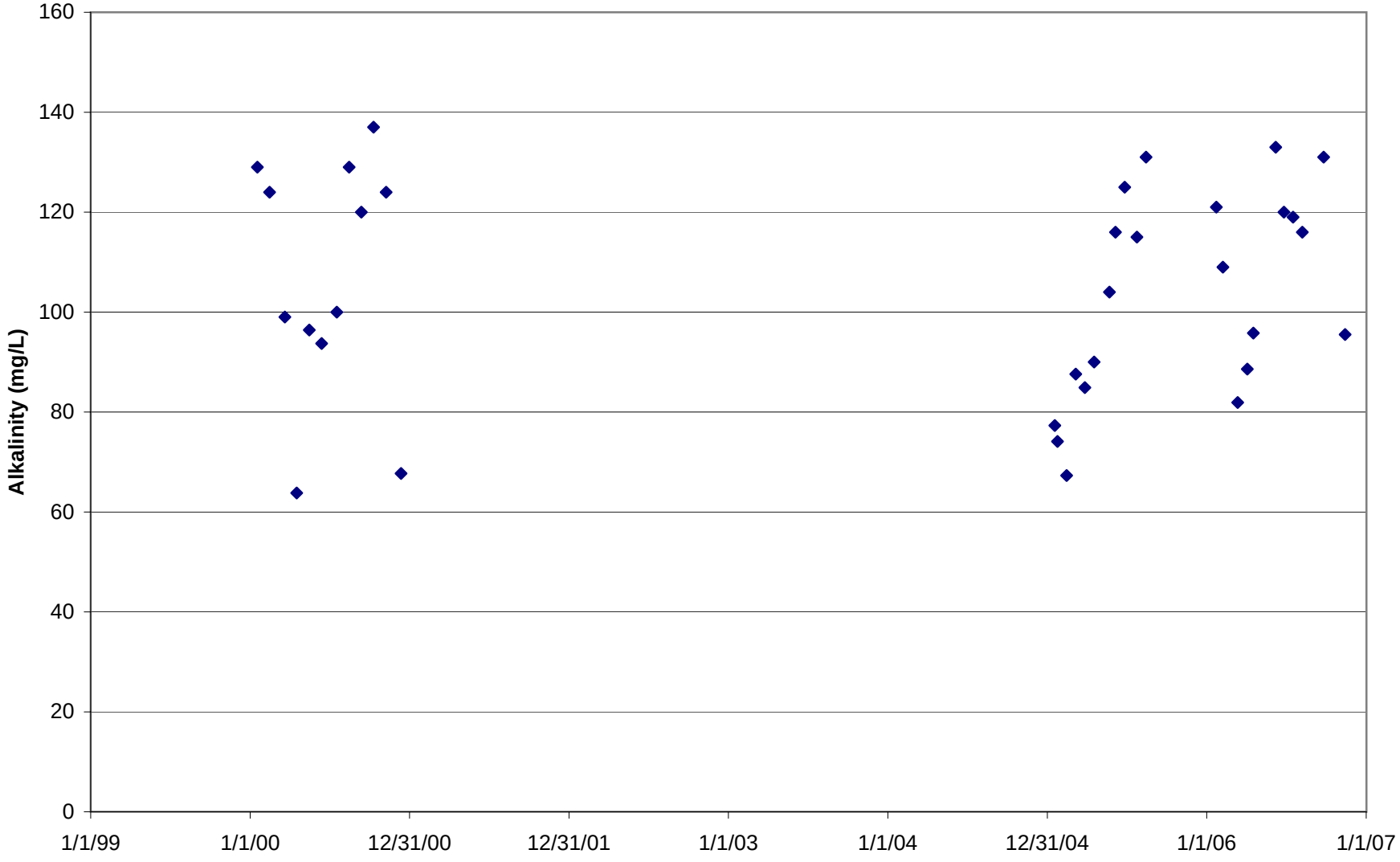


Figure C.10. Observed TKN in Lake Palourde near Morgan City (LDEQ 0338)

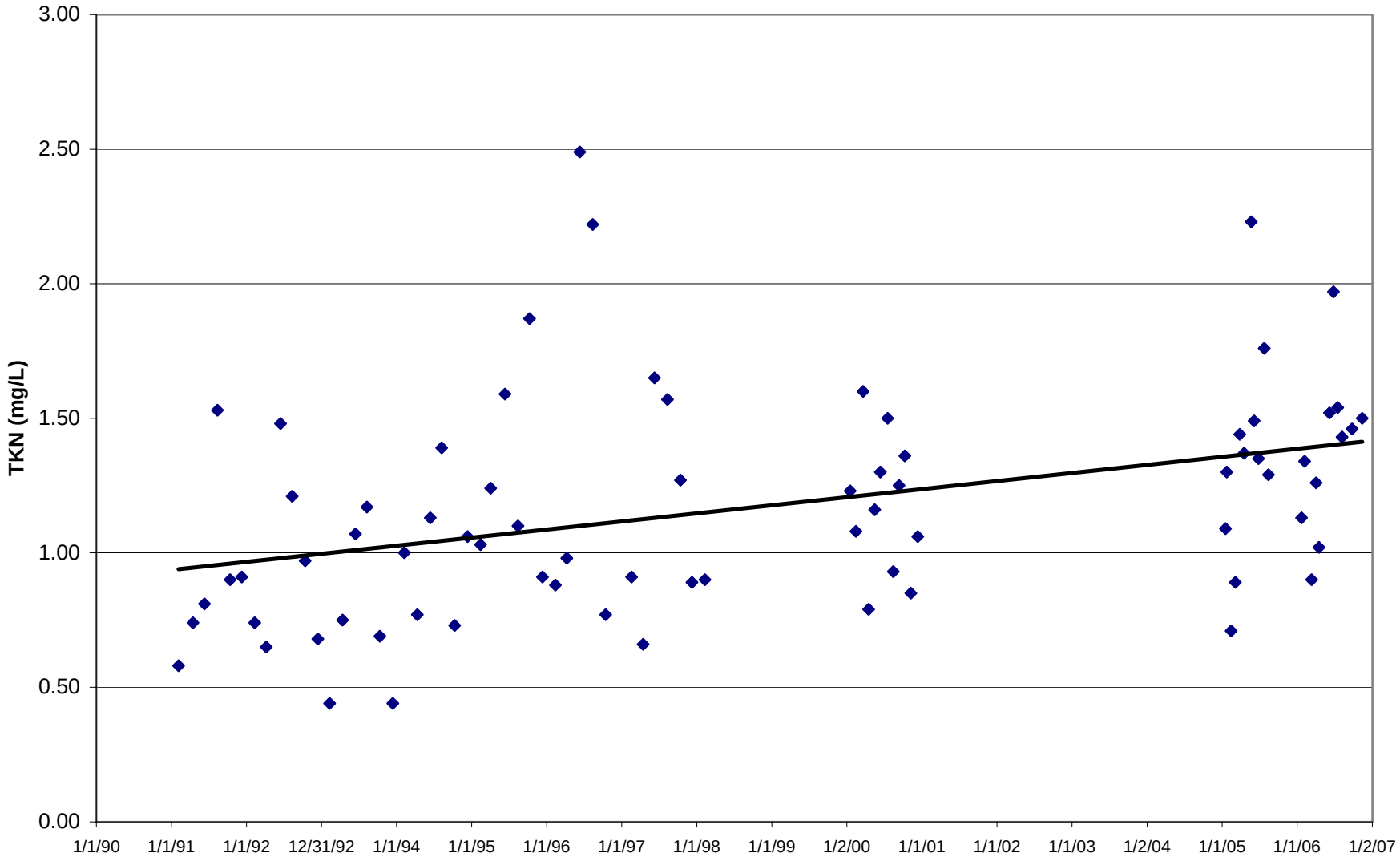


Figure C.11. Observed TKN in Bayou Chene southeast of Morgan City (LDEQ 0342)

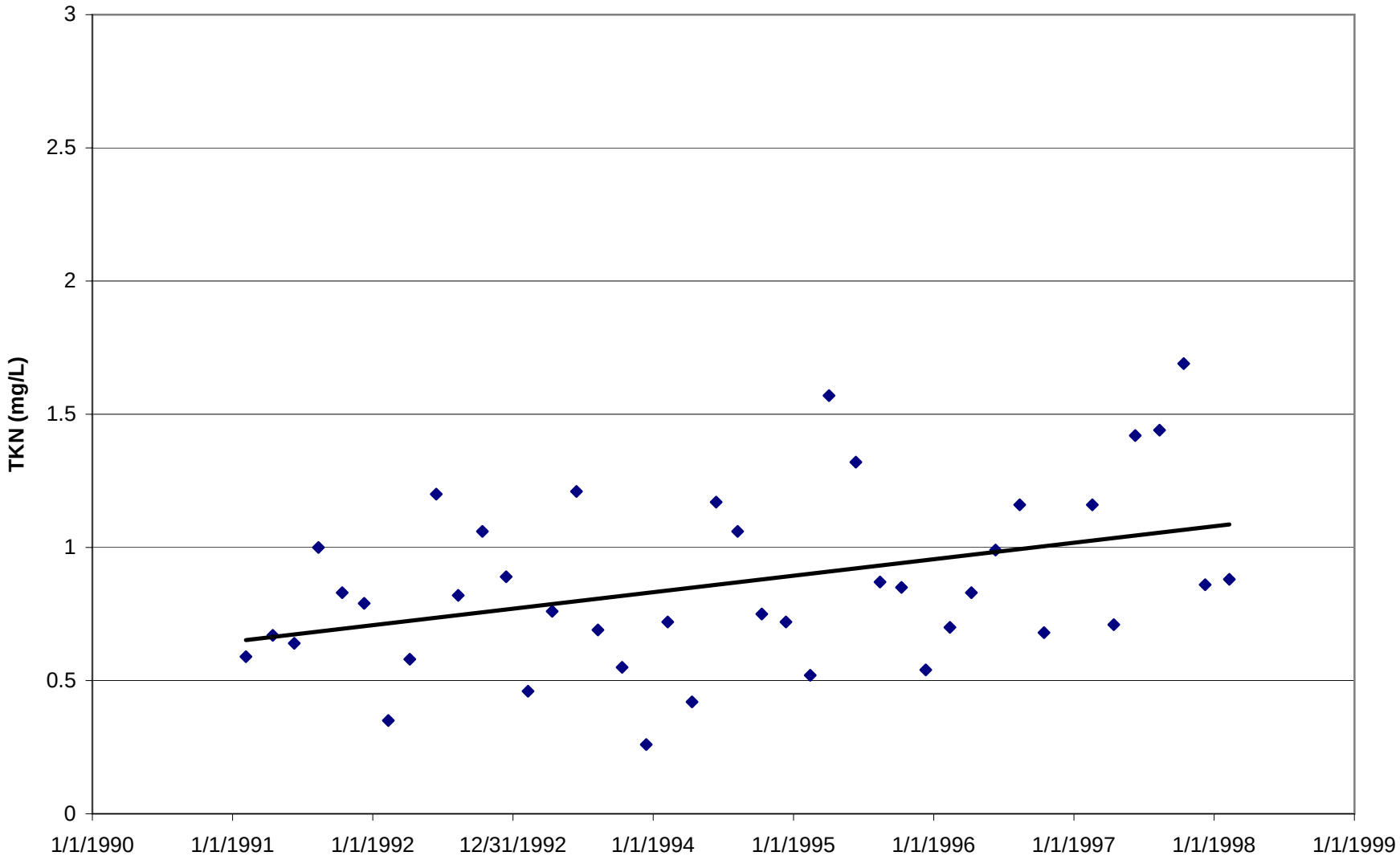


Figure C.12. Observed TKN in Bayou Avoca at Sword Bayou (LDEQ 0933)

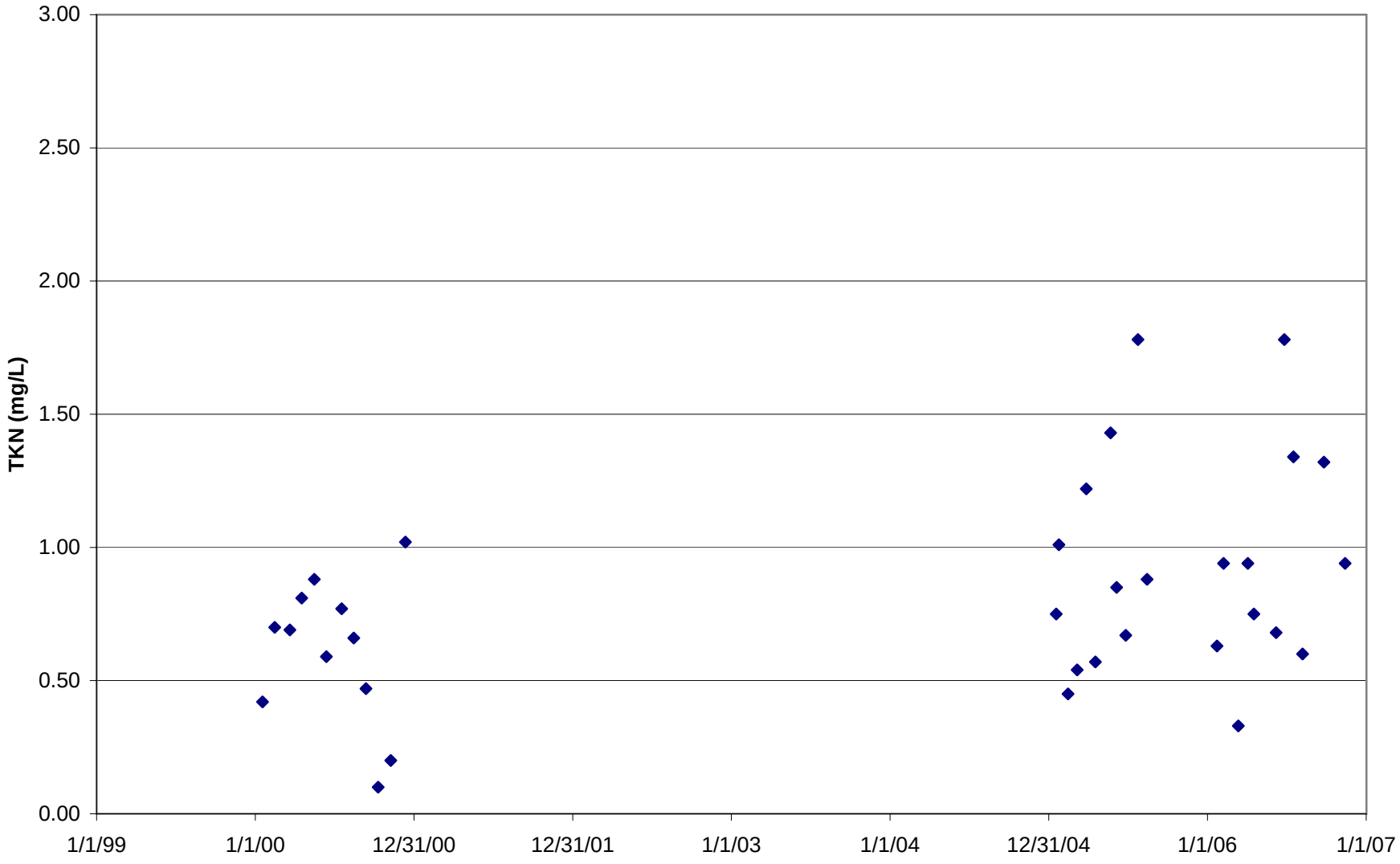


Figure C.13. Observed Total Phosphorus in Lake Palourde near Morgan City (LDEQ 0338)

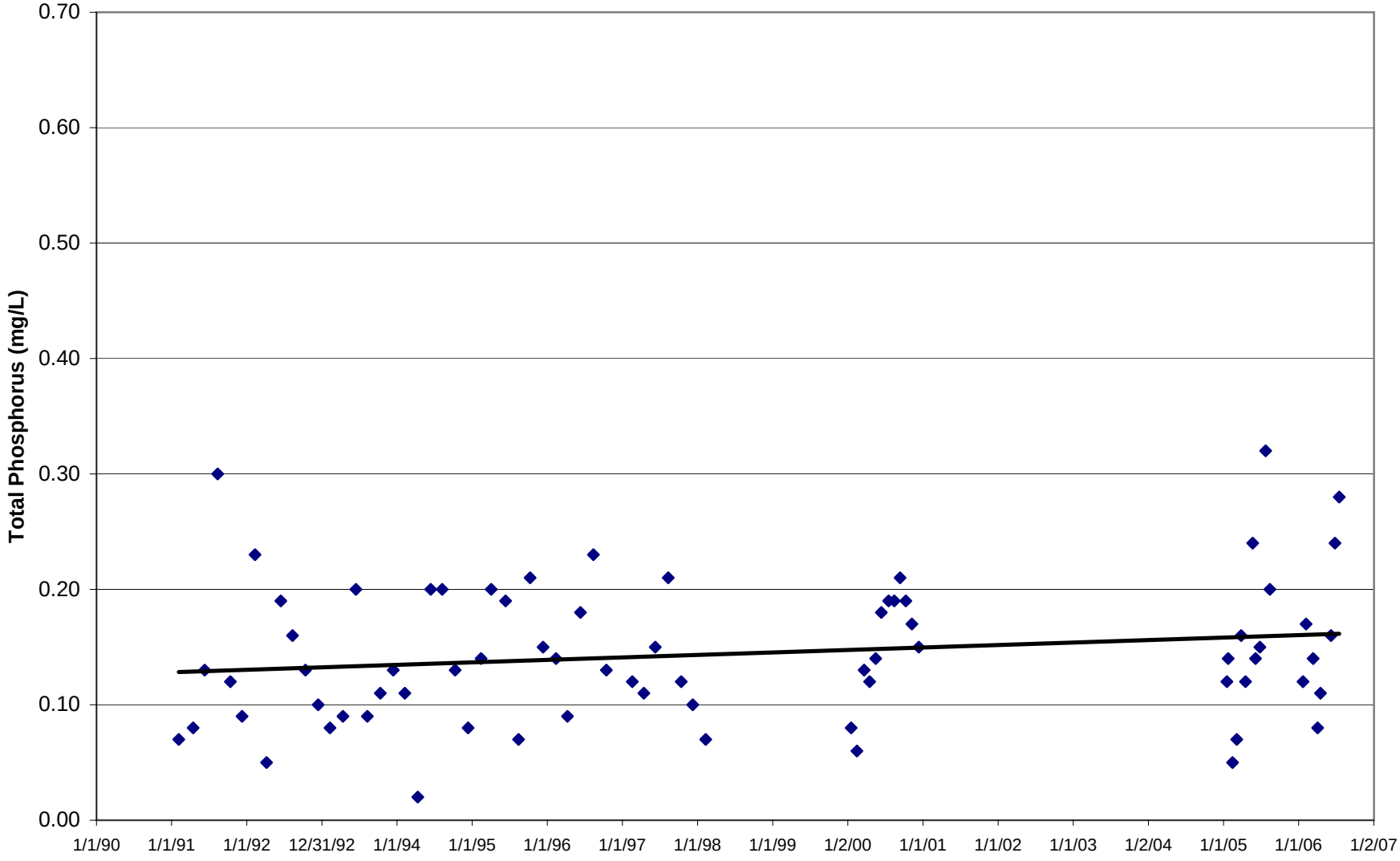


Figure C.14. Observed Total Phosphorus in Bayou Chene southeast of Morgan City (LDEQ 0342)

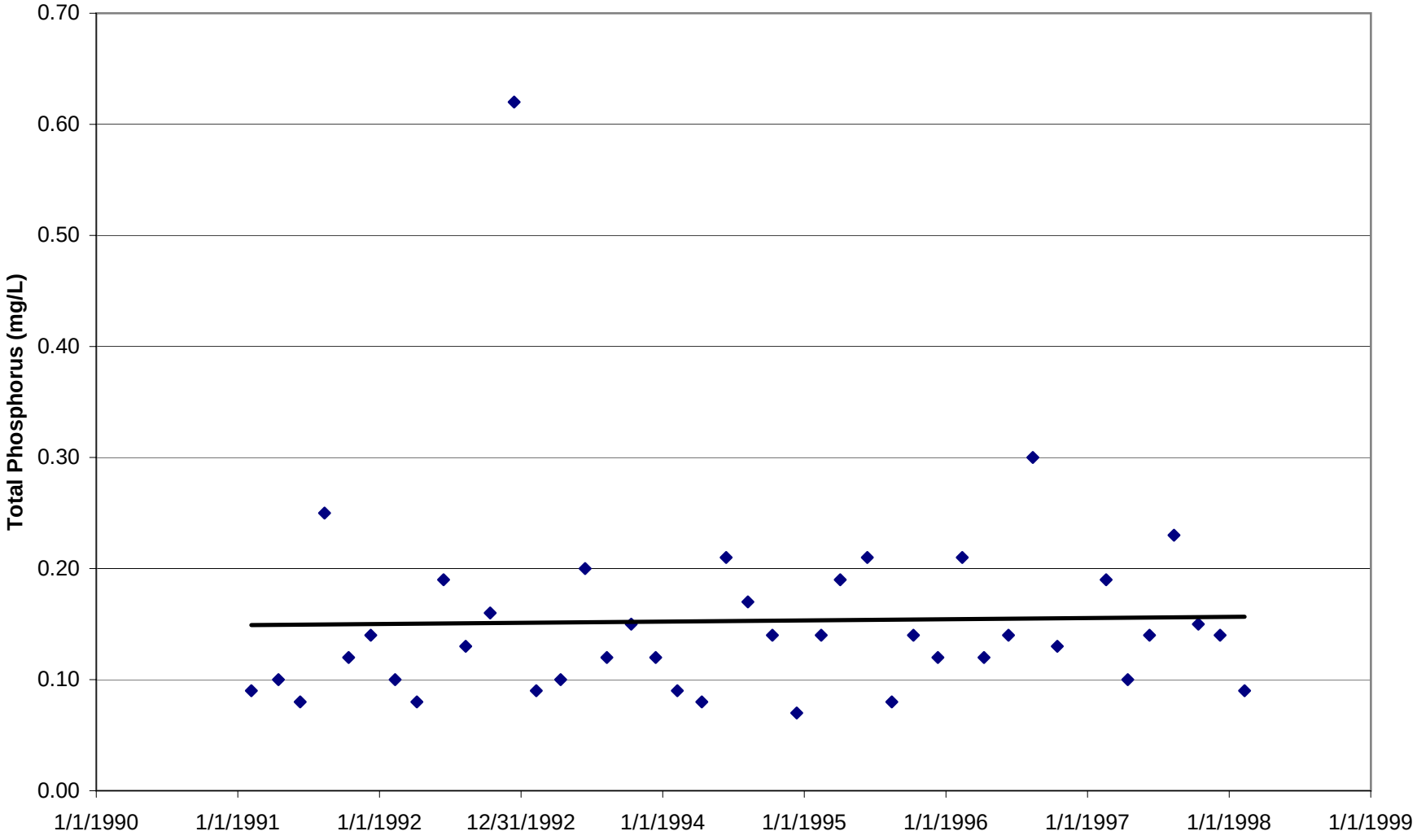


Figure C.15. Observed Total Phosphorus in Bayou Avoca at Sword Bayou (LDEQ 0933)

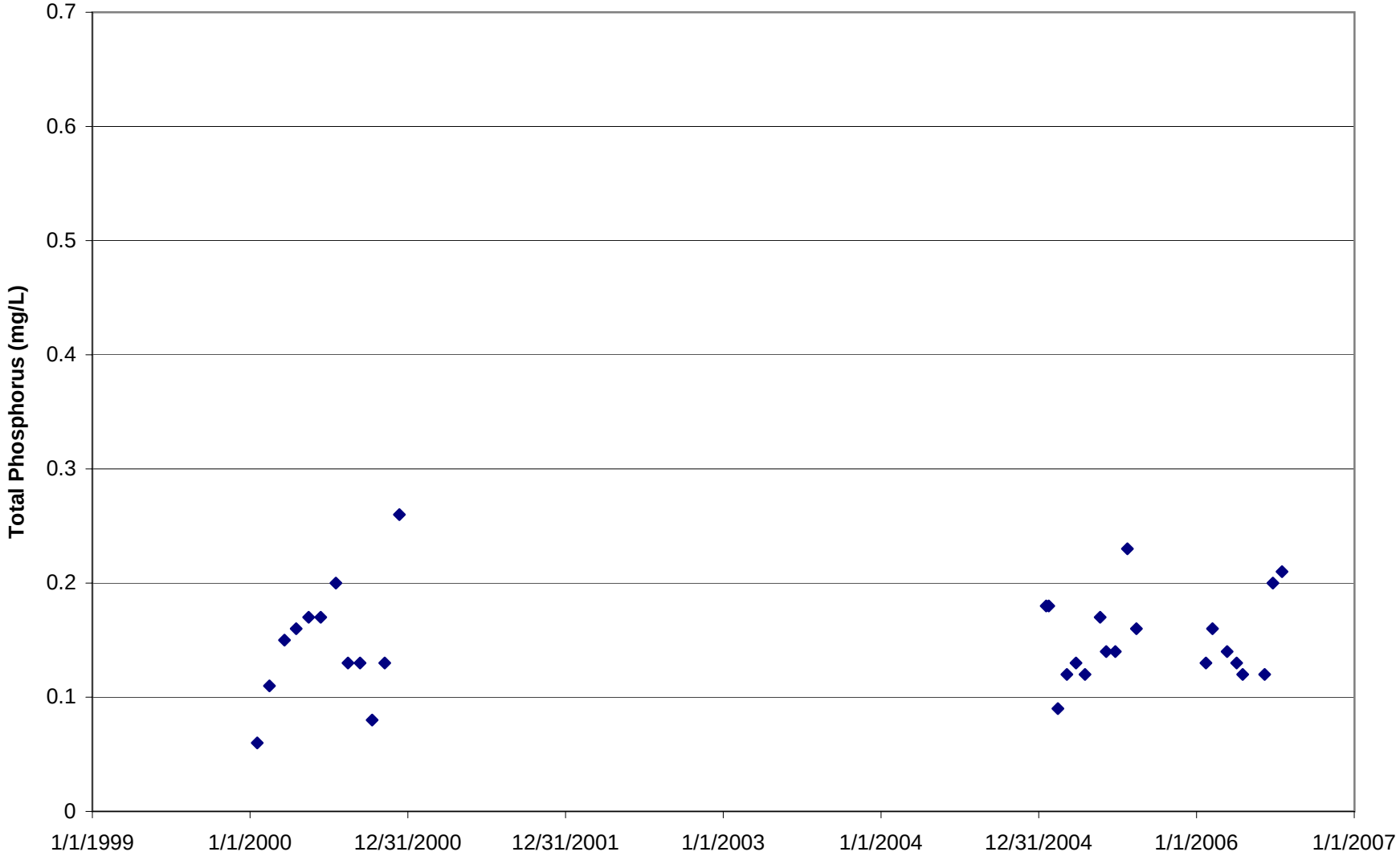


Figure C.16. Observed Nitrate + Nitrite in Lake Palourde near Morgan City (LDEQ 0338)

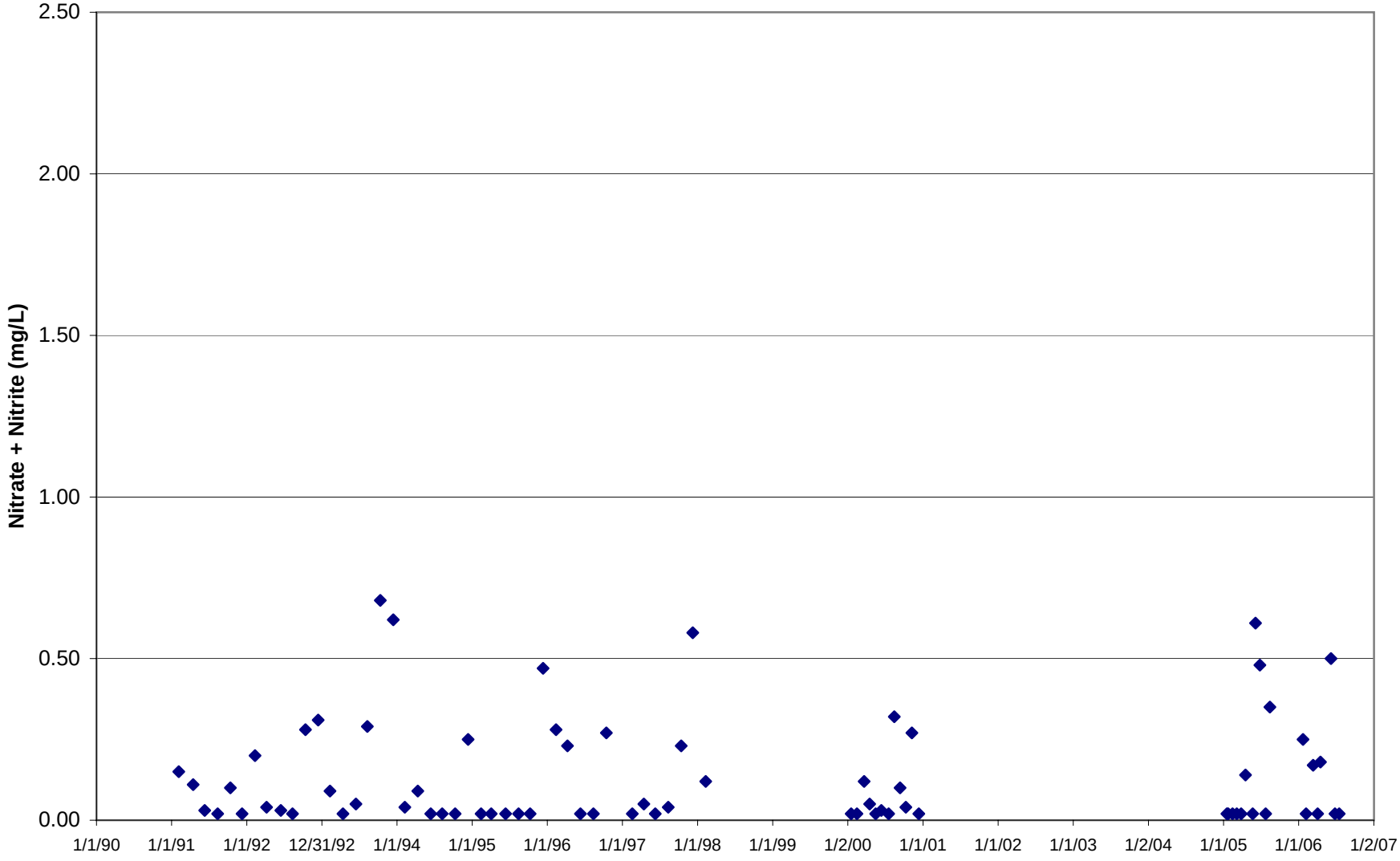


Figure C.17. Observed Nitrate + Nitrite in Bayou Chene southeast of Morgan City (LDEQ 0342)

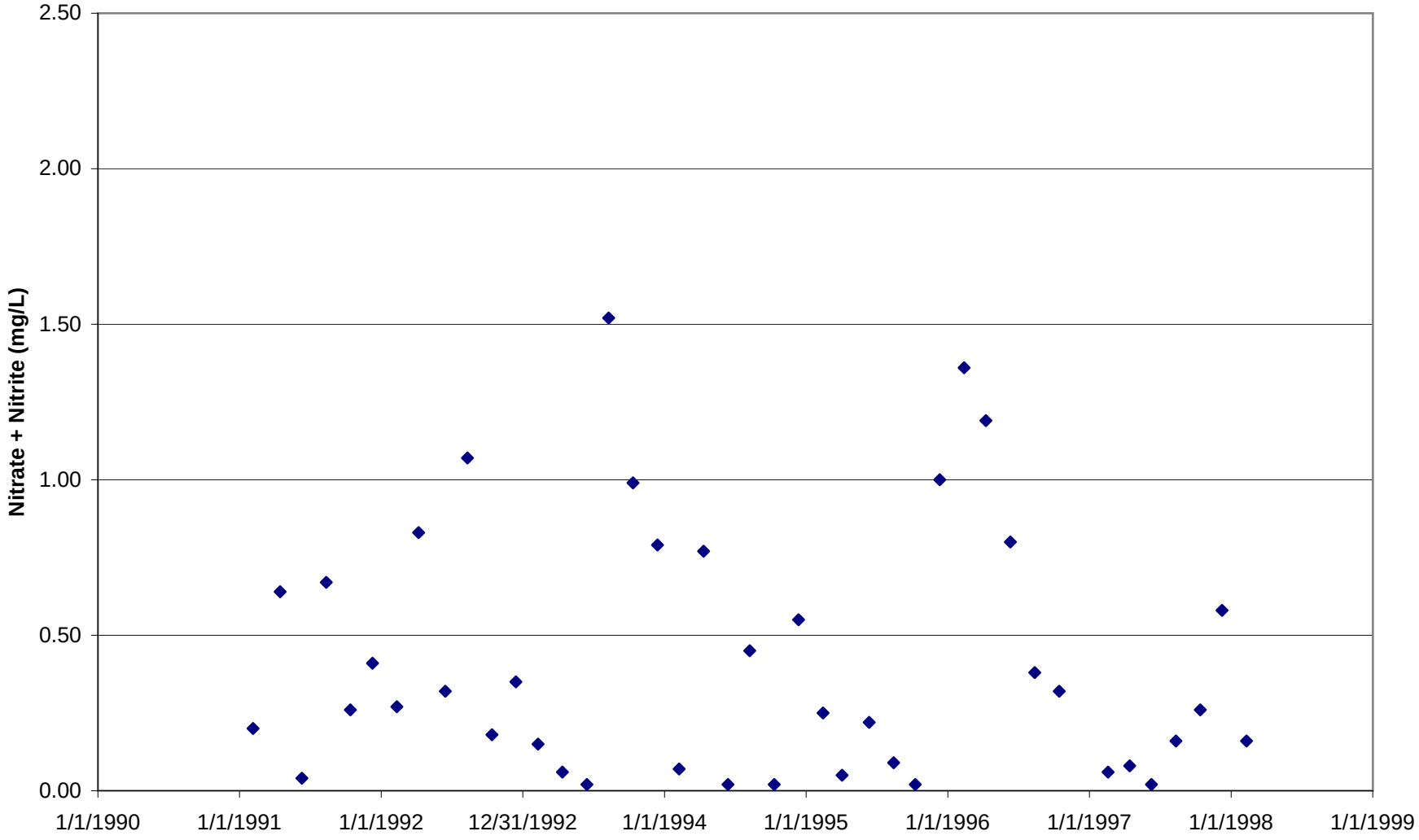


Figure C.18. Observed Nitrate + Nitrite in Bayou Avoca at Sword Bayou (LDEQ 0933)

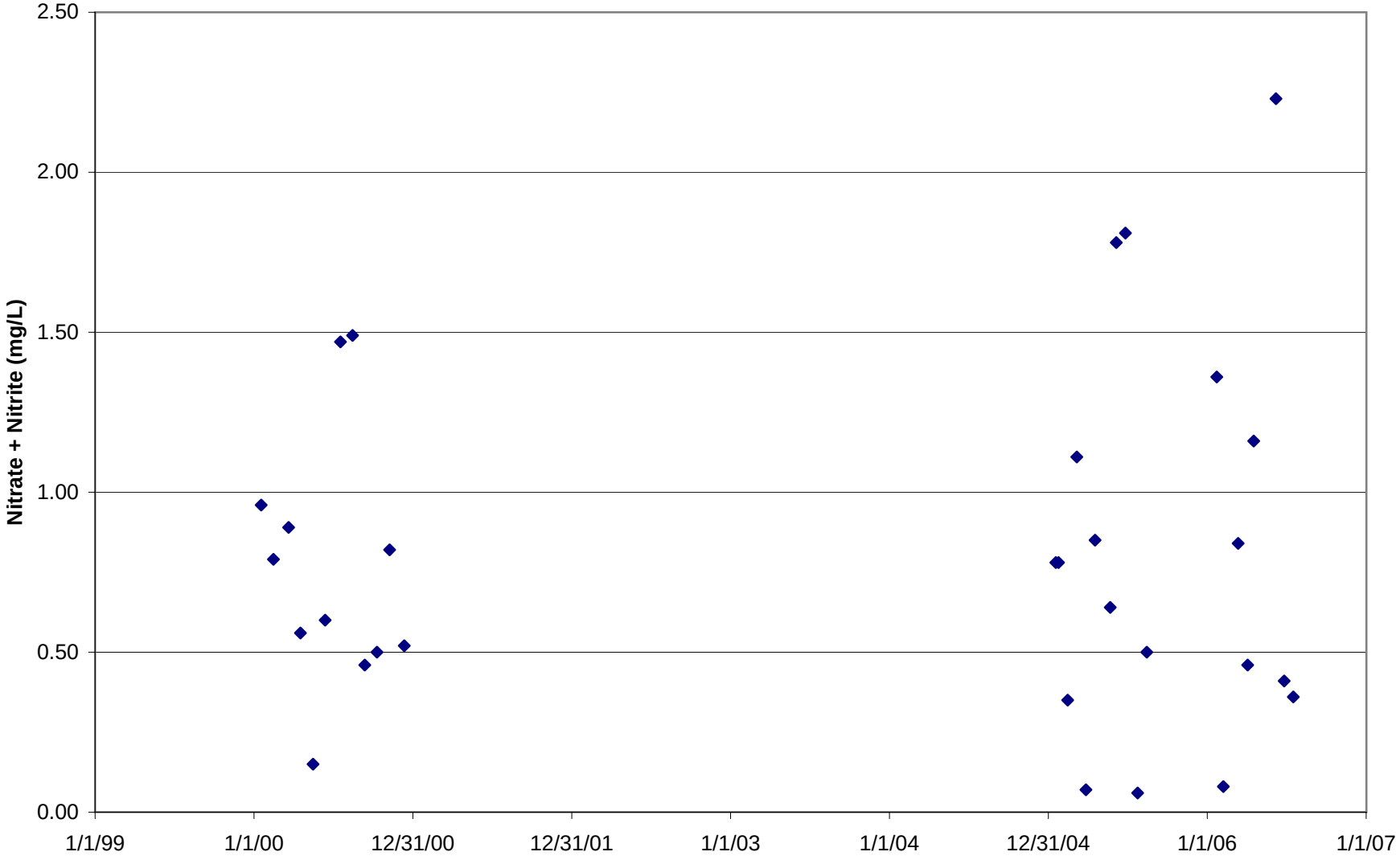


Figure C.19. Observed Ammonia in Lake Palourde near Morgan City (LDEQ 338)

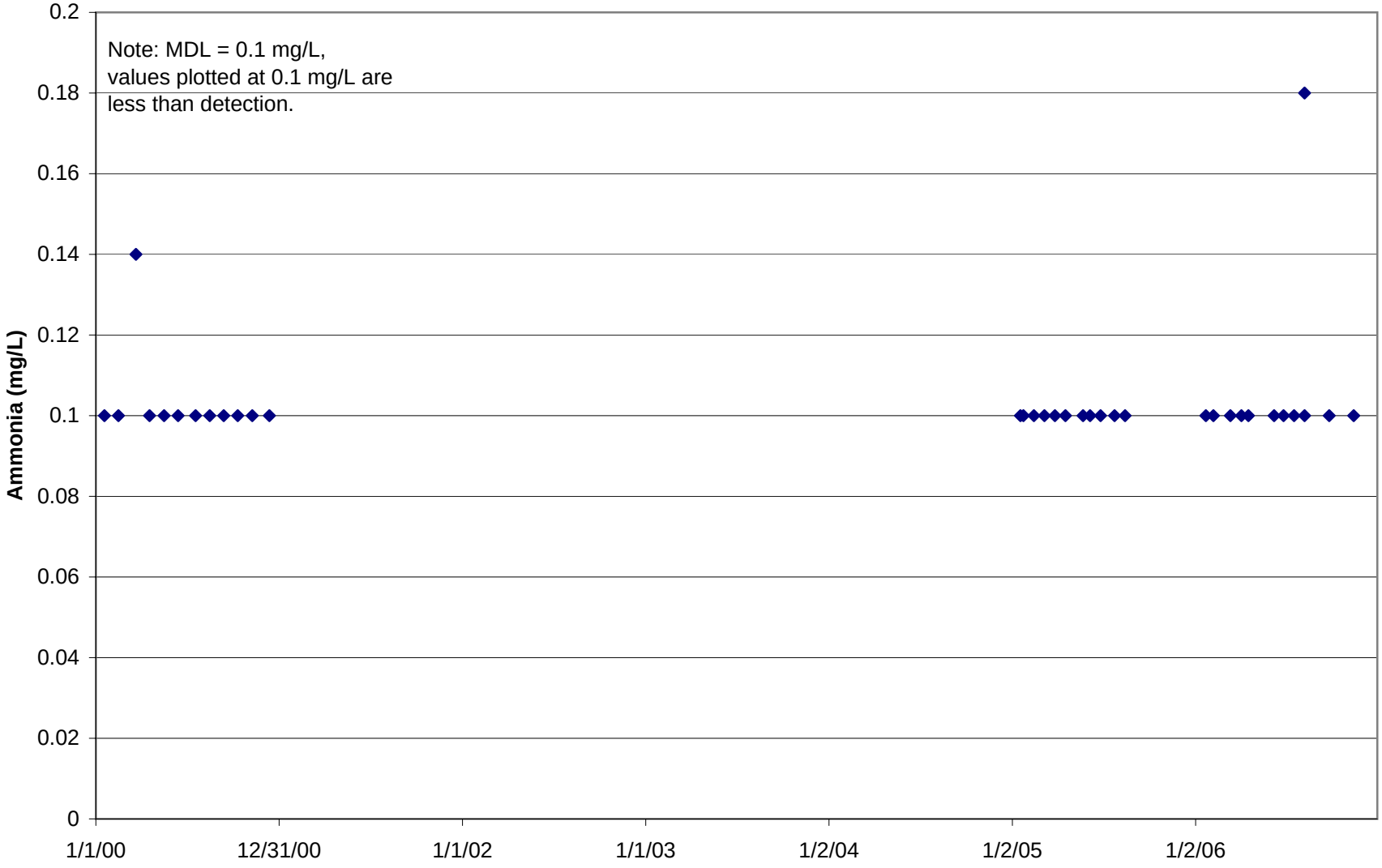
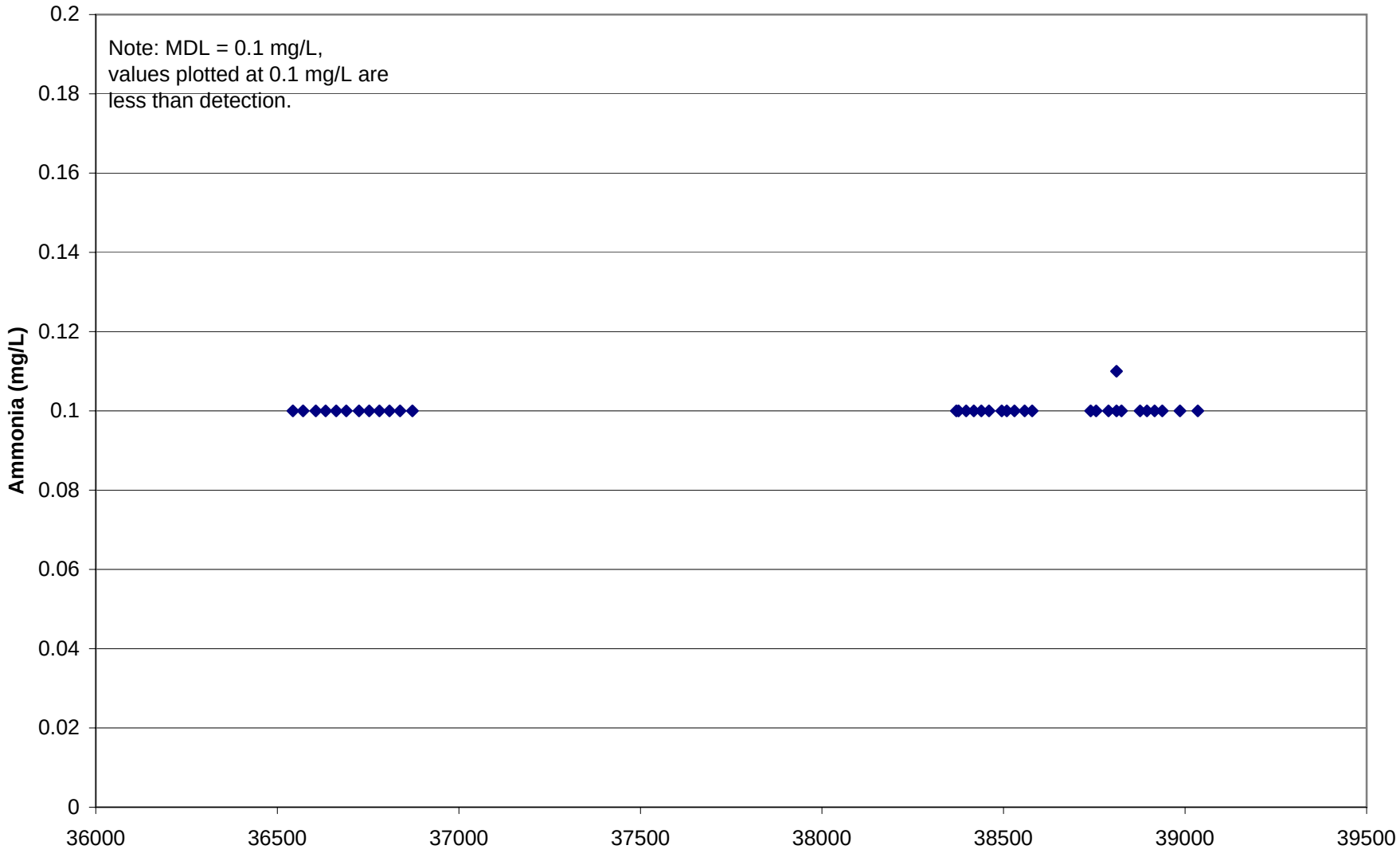


Figure C.20. Observed Ammonia in Bayou Avoca at Sword Bayou (LDEQ 933)



APPENDIX D

Field Data Plots

Figure D.1. Continuous Monitoring DO data for Lake Palourde near Morgan City (LDEQ 338)

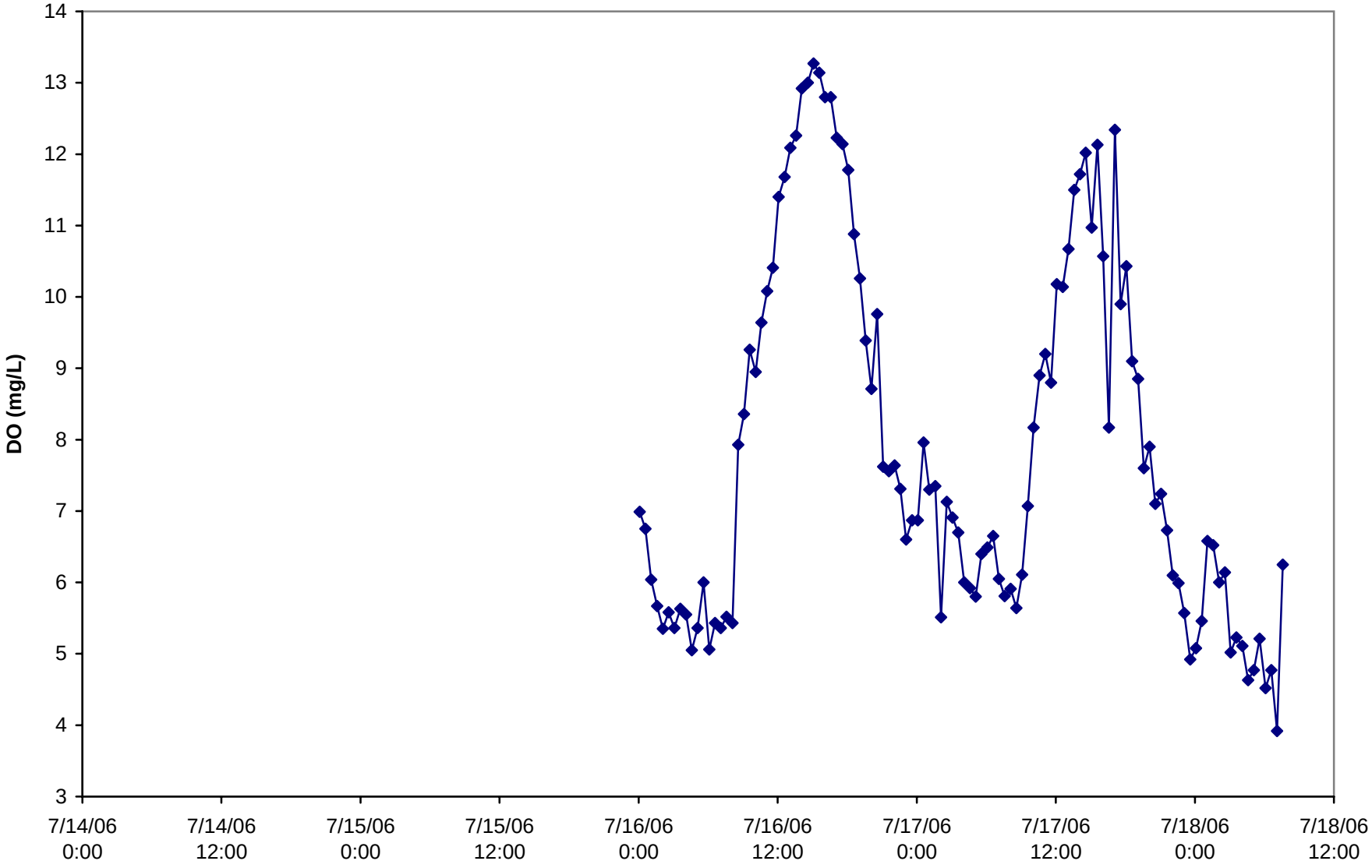


Figure D.2. Continuous Monitoring DO percent saturation data for Lake Palourde near Morgan City (LDEQ 338)

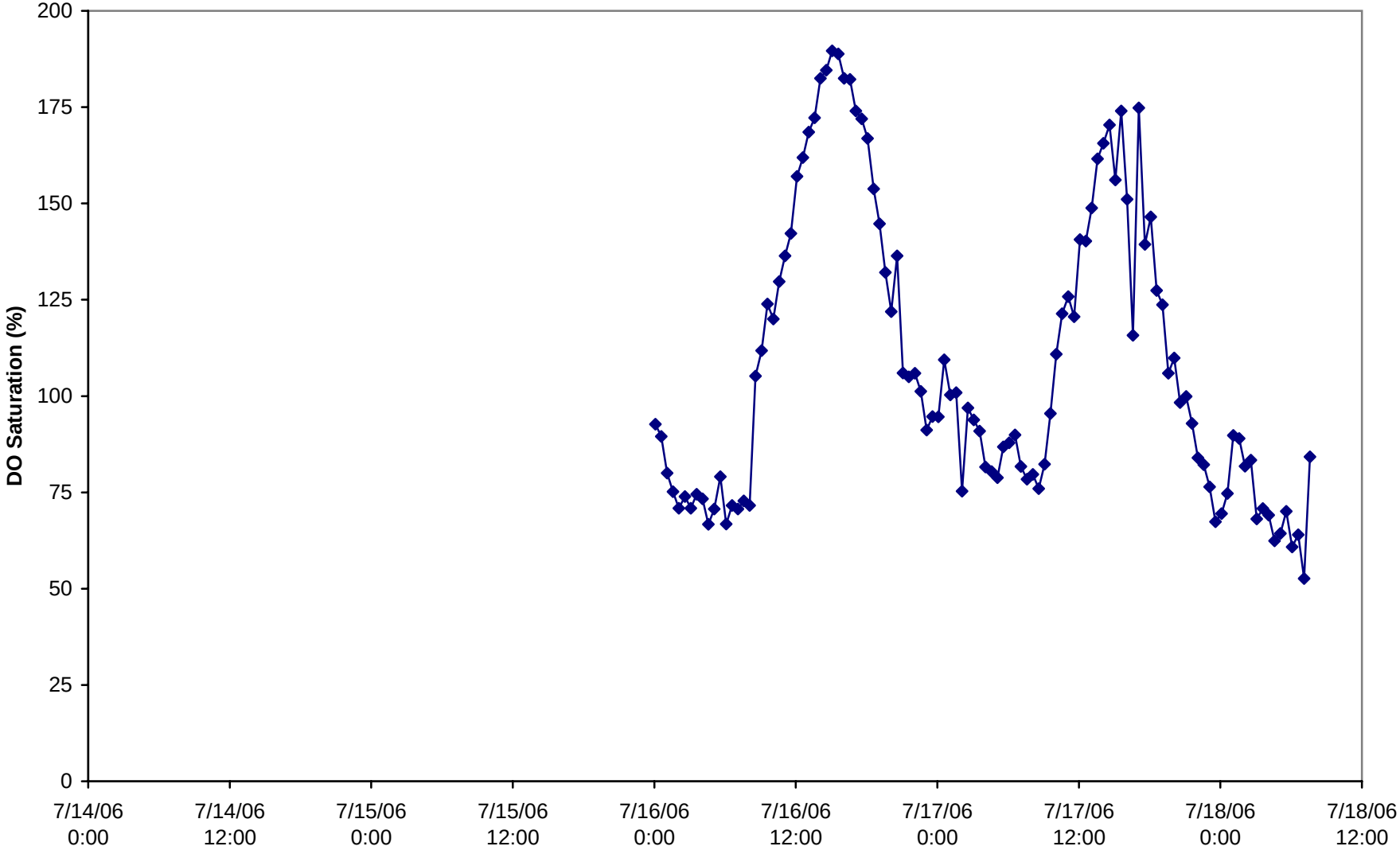


Figure D.3. Continuous Monitoring temperature data for Lake Palourde near Morgan City (LDEQ 338)

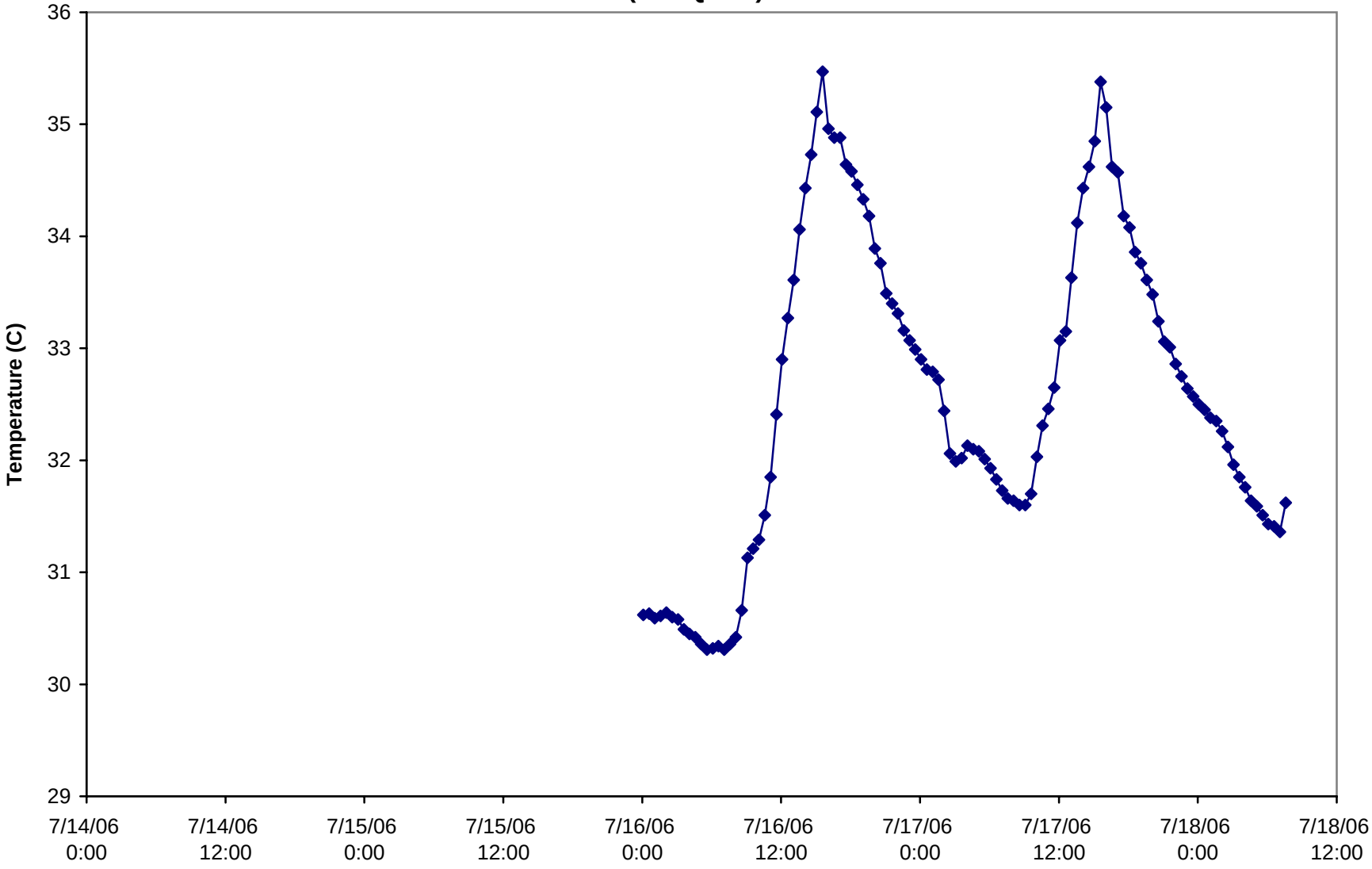


Figure D.4. Continuous Monitoring pH data for Lake Palourde near Morgan City (LDEQ 338)

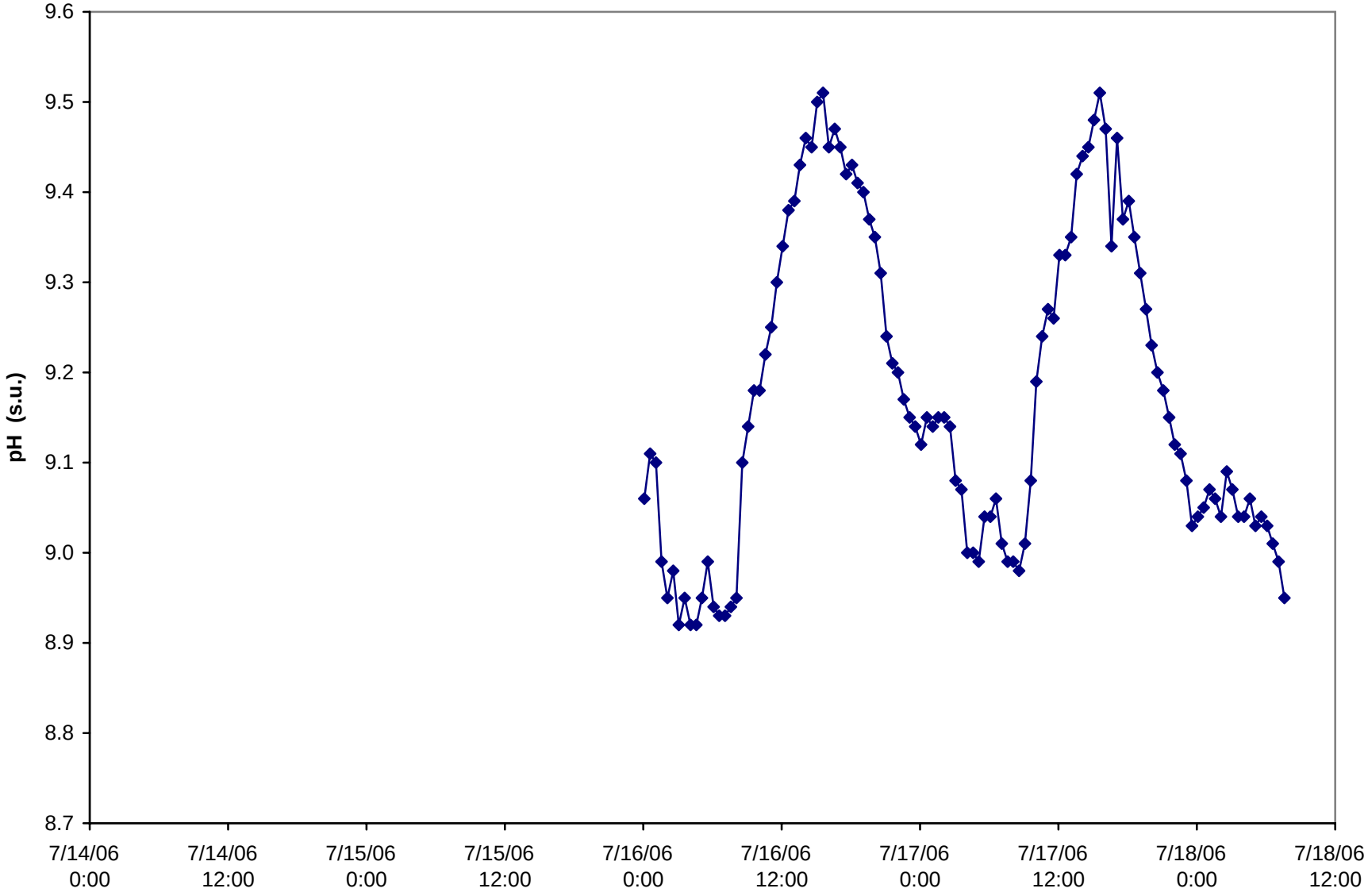


Figure D.5. Continuous Monitoring specific conductivity data Lake Palourde near Morgan City (LDEQ 338)

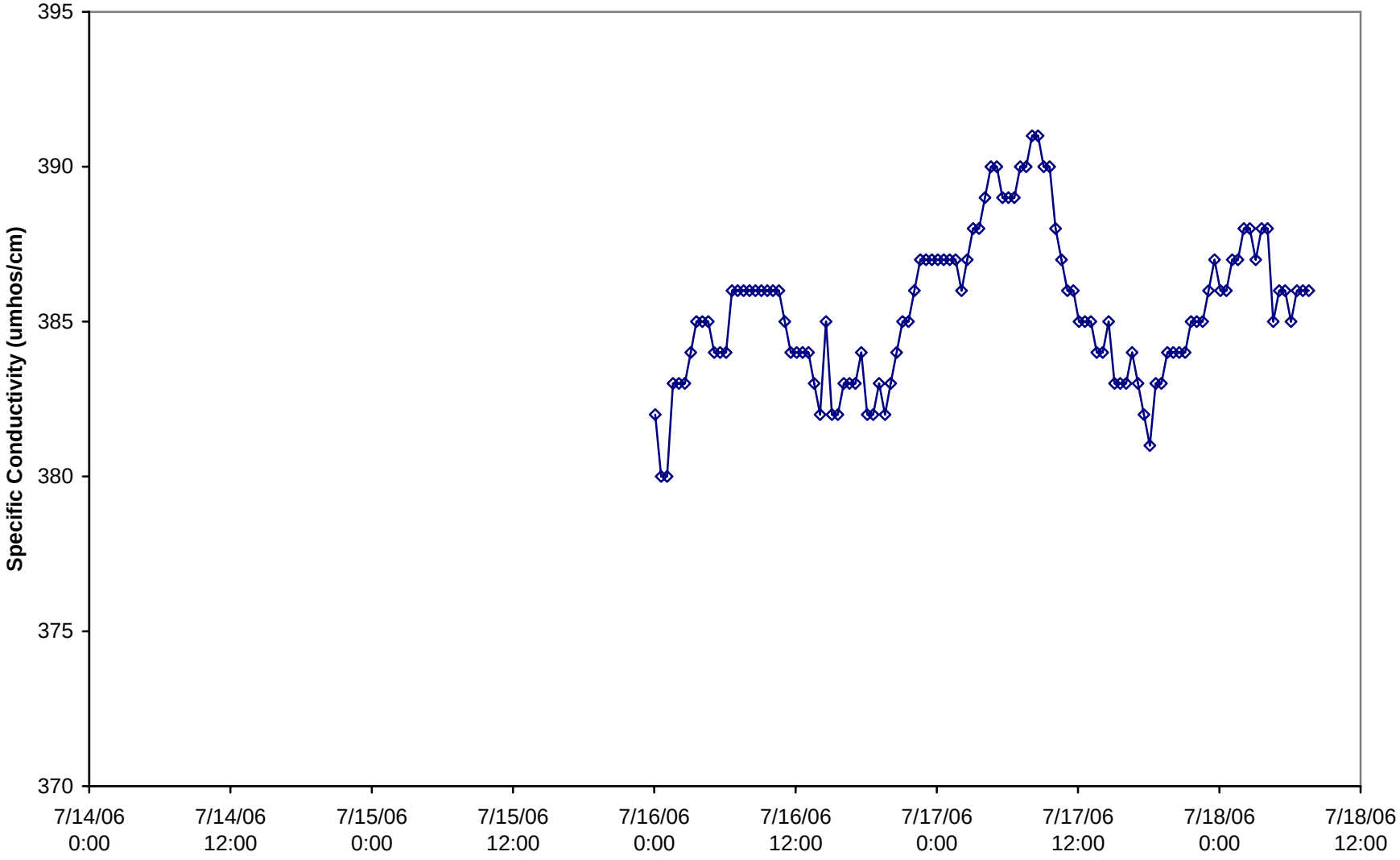


Figure D.6. Continuous monitoring DO data for Lake Palourde near Morgan City (LDEQ 338)

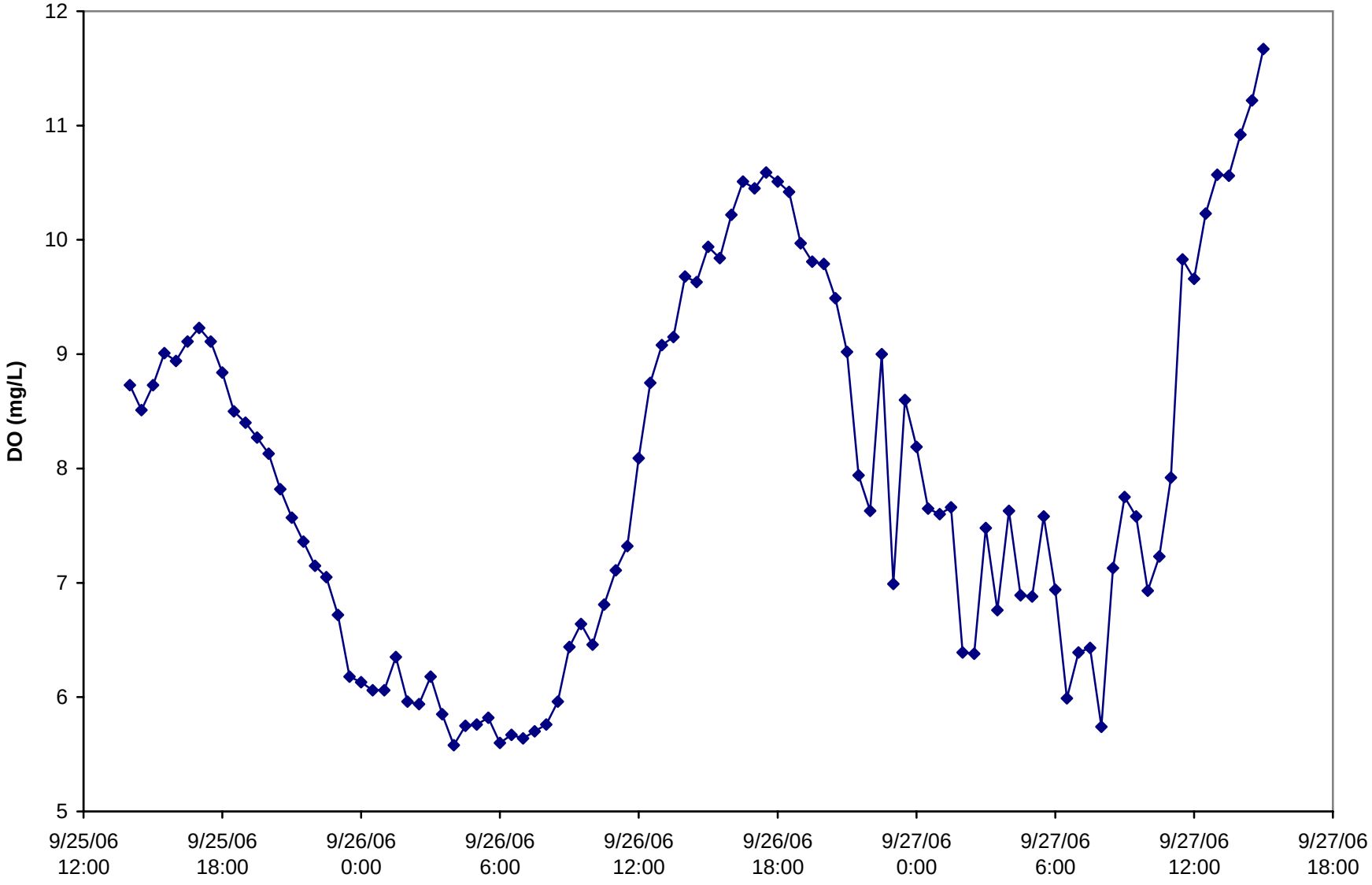


Figure D.7. Continuous monitoring percent saturation DO data for Lake Palourde near Morgan City (LDEQ 338)

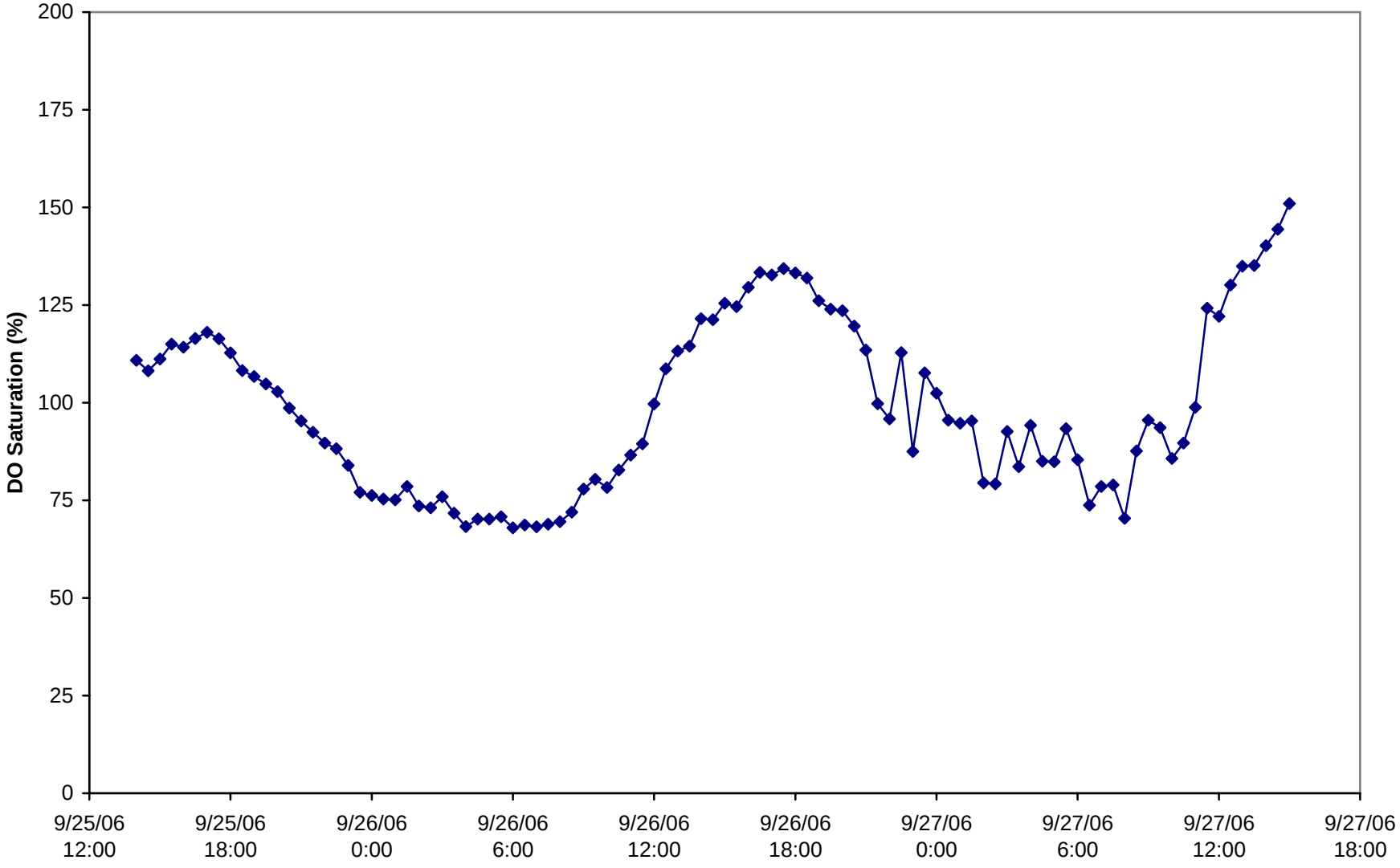


Figure D.8. Continuous monitoring temperature data for Lake Palourde near Morgan City (LDEQ 338)

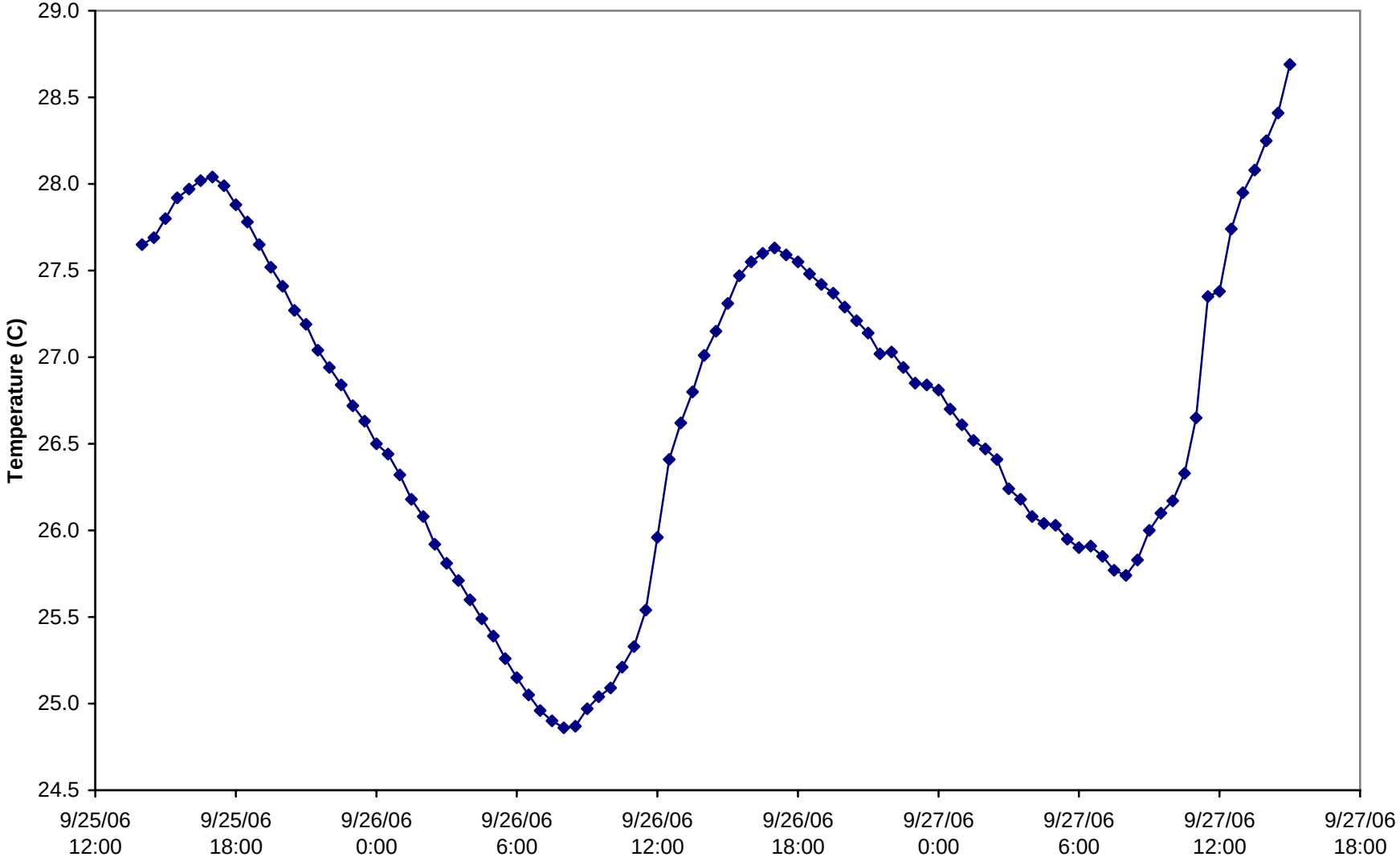


Figure D.9. Continuous monitoring pH data for Lake Palourde near Morgan City (LDEQ 338)

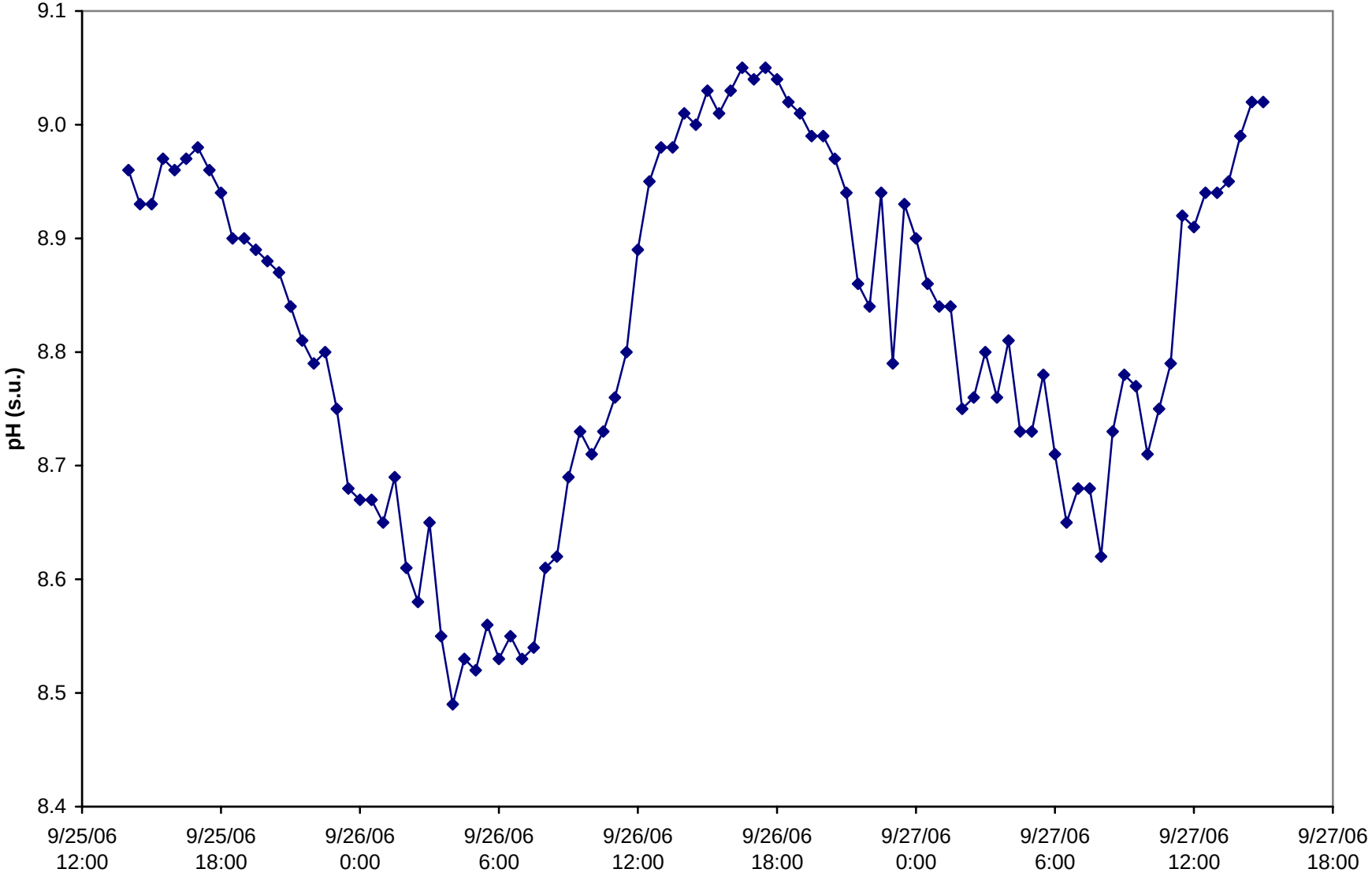


Figure D.10. Continuous monitoring specific conductivity data for Lake Palourde near Morgan City (LDEQ 338)

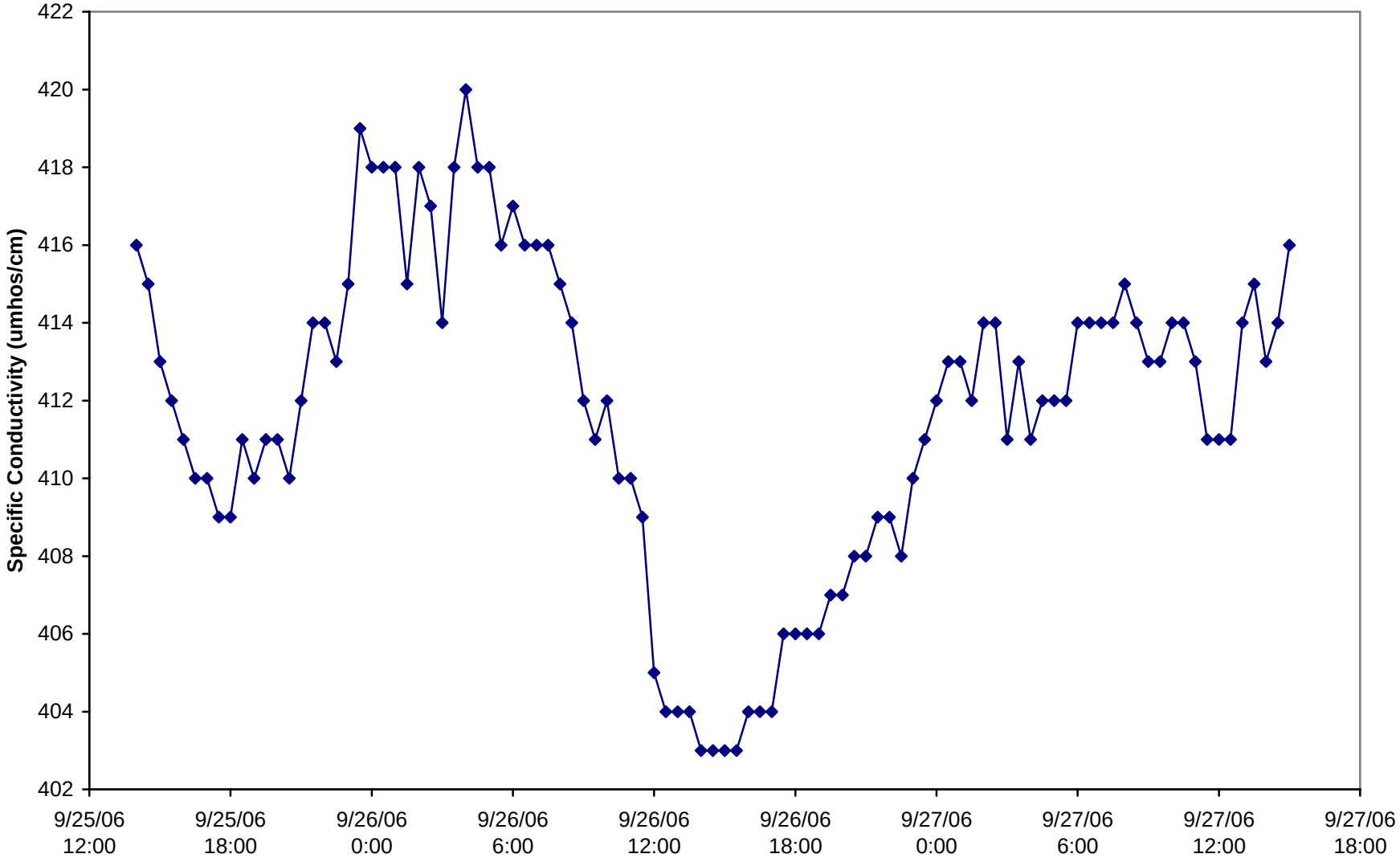


Figure D.11. Continuous Monitoring DO data at Bayou Avoca at Sword Bayou, Louisiana (LDEQ 933)

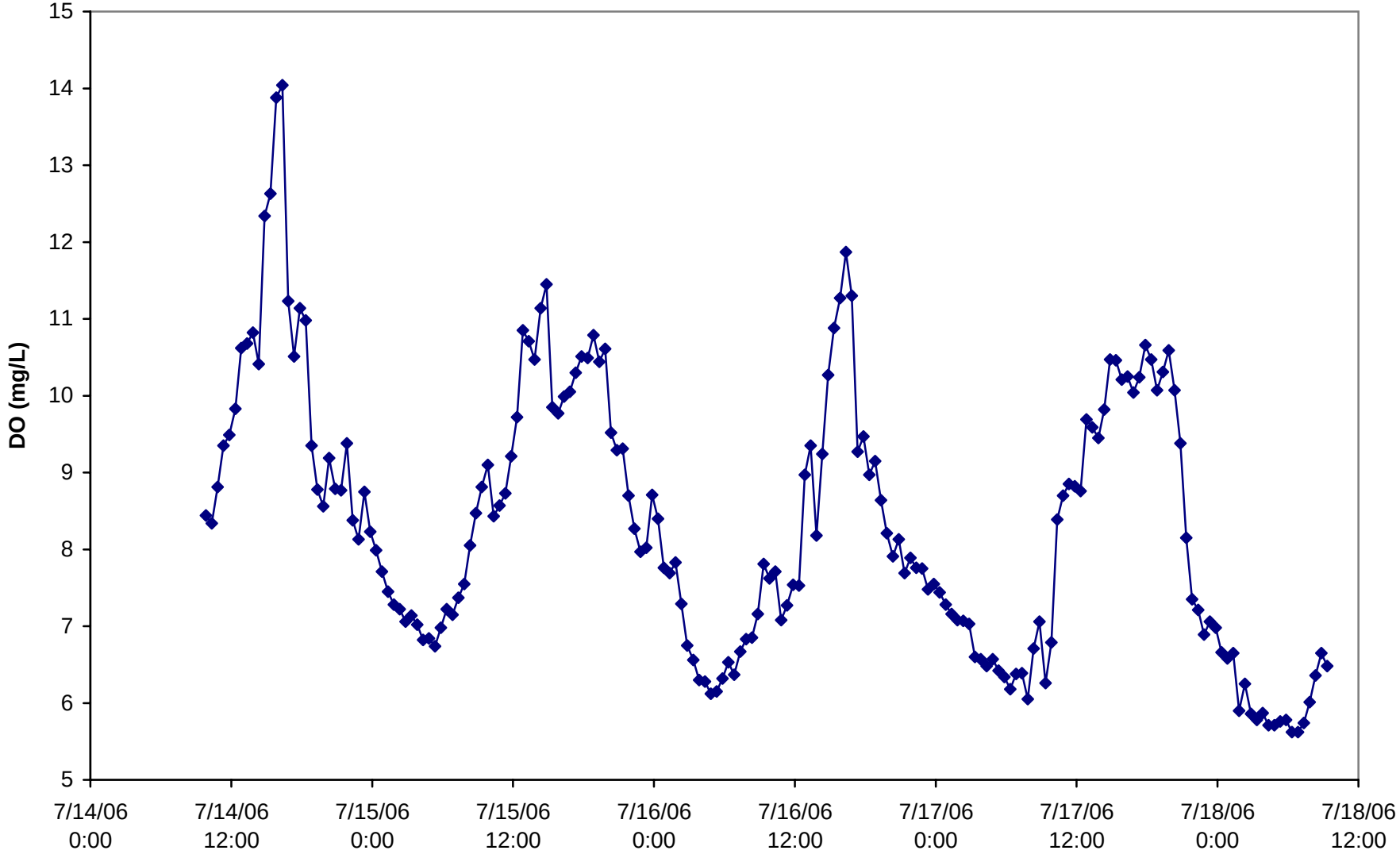


Figure D.12. Continuous Monitoring DO percent saturation data at Bayou Avoca at Sword Bayou, Louisiana (LDEQ 933)

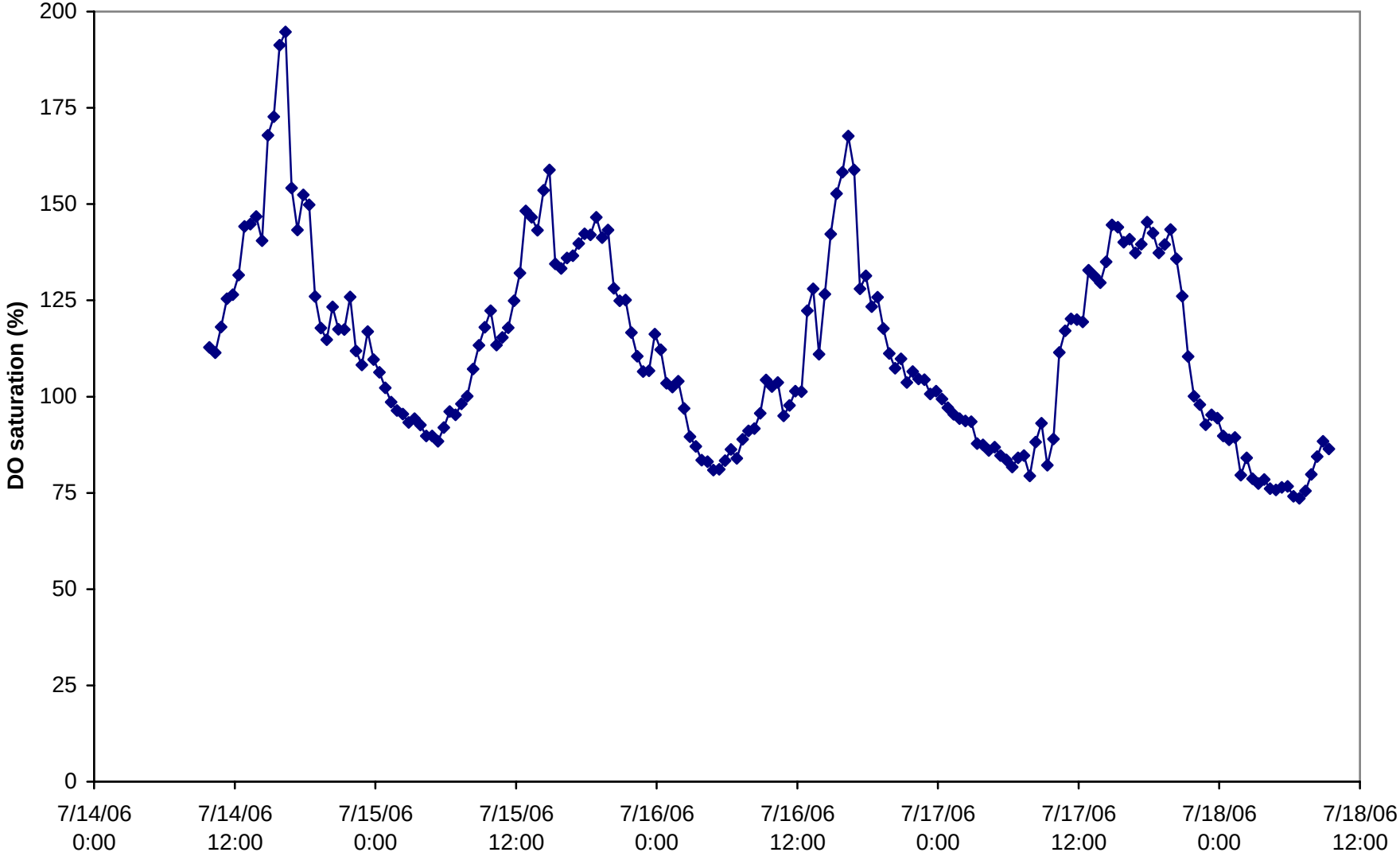


Figure D.13. Continuous Monitoring temperature data at Bayou Avoca at Sword Bayou, Louisiana (LDEQ 933)

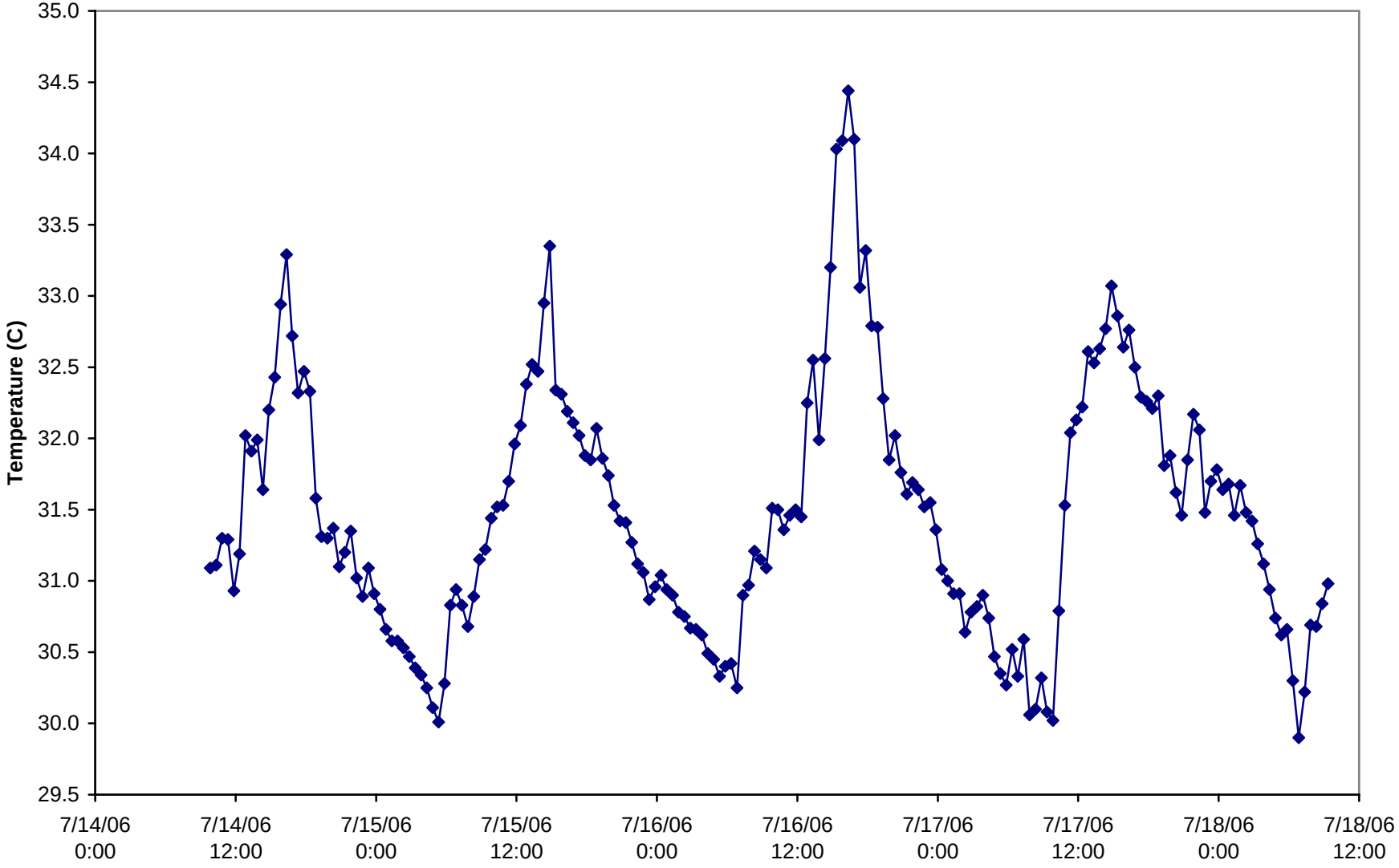


Figure D.14. Continuous Monitoring pH data at Bayou Avoca at Sword Bayou, Louisiana (LDEQ 933)

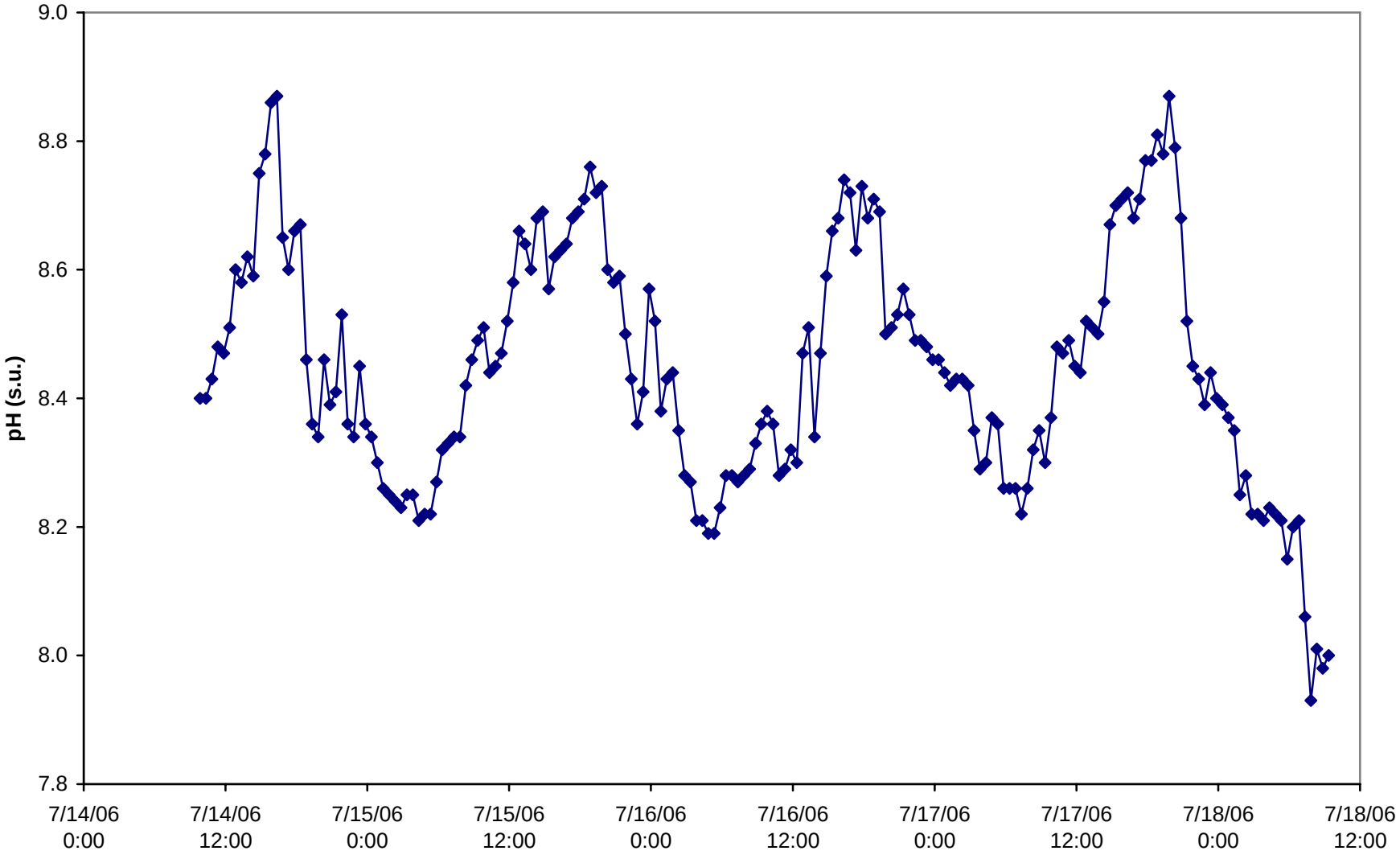
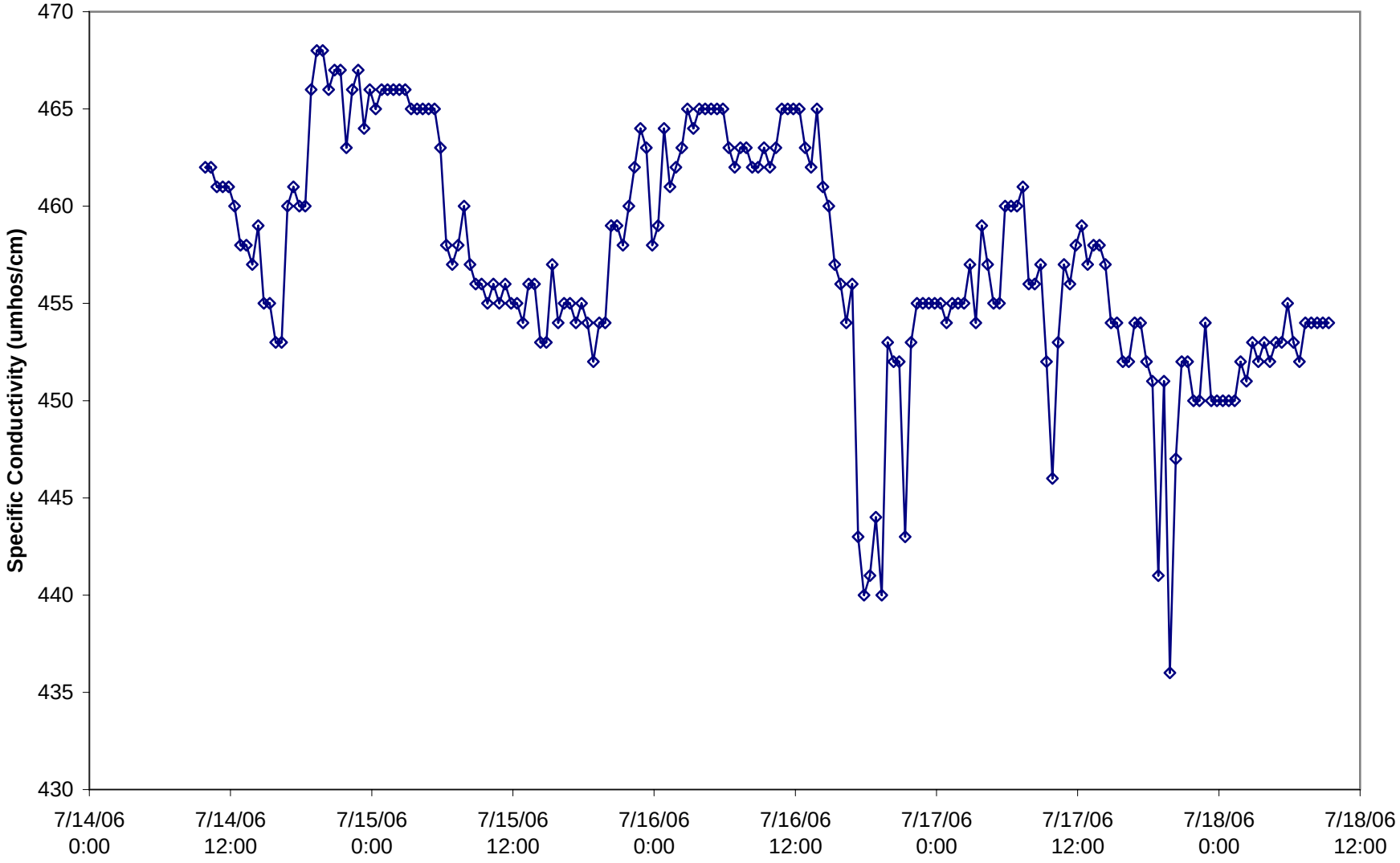


Figure D.15. Continuous Monitoring specific conductivity data at Bayou Avoca at Sword Bayou, Louisiana (LDEQ 933)



APPENDIX E

Calibrated Models Inputs

QUAL2Kw (version 5.1)

Stream Water Quality Model

Greg Pelletier, Steve Chapra, and Hua Tao

Department of Ecology and Tufts University

System ID:		
River name	**Lake Palourde**	
Saved file name	**Palourde-July-calib2**	
Directory where the input/output files are saved	**R:\projects\2110-622\tech\qual2k\qual2kw\qual2kw\v51b37\palourde**	
Month	**7**	
Day	**16**	
Year	**2006**	
Time zone	**Central**	
Daylight savings time	**Yes**	
Simulation and output options:		
Calculation step	**11.25**	**minutes**
Number of days	**2000**	**days**
Solution method (integration)	**Euler**	
Solution method (pH)	**Newton-Raphson**	
Simulate hyporheic exchange and pore water quality	**No**	
Display dynamic diel output	**Yes**	
State variables for simulation	**All**	
Simulate sediment diagenesis	**Yes**	
Program determined calc step	**11.25**	**minutes**
Time elapsed during last model run	**0.47**	**minutes**
Time of sunrise	**6:14 AM**	
Time of solar noon	**1:10 PM**	
Time of sunset	**8:06 PM**	
Photoperiod	**13.86**	**hours**

QUAL2Kw

Stream Water Quality Model

Lake Palourde (7/16/2006)

Headwater and Downstream Boundary Data:

Headwater Flow	51.940	m3/s								
Prescribed downstream boundary?	No									
Headwater Water Quality	***Units***	***12:00 AM***	***1:00 AM***	***2:00 AM***	***3:00 AM***	***4:00 AM***	***5:00 AM***	***6:00 AM***	***7:00 AM***	***8:00 AM***
Temperature	C	30.62	30.59	30.64	30.58	30.45	30.36	30.32	30.31	30.42
Conductivity	umhos	384.00	384.00	384.00	384.00	384.00	384.00	384.00	384.00	384.00
Inorganic Solids	mgD/L	14.17	14.17	14.17	14.17	14.17	14.17	14.17	14.17	14.17
Dissolved Oxygen	mg/L	8.61	8.61	8.61	8.61	8.61	8.61	8.61	8.61	8.61
CBODslow	mgO2/L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CBODfast	mgO2/L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Organic Nitrogen	ugN/L	1589.00	1589.00	1589.00	1589.00	1589.00	1589.00	1589.00	1589.00	1589.00
NH4-Nitrogen	ugN/L	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
NO3-Nitrogen	ugN/L	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
Organic Phosphorus	ugP/L	203.30	203.30	203.30	203.30	203.30	203.30	203.30	203.30	203.30
Inorganic Phosphorus (SRP)	ugP/L	101.70	101.70	101.70	101.70	101.70	101.70	101.70	101.70	101.70
Phytoplankton	ugA/L	66.50	66.50	66.50	66.50	66.50	66.50	66.50	66.50	66.50
Detritus (POM)	mgD/L	10.83	10.83	10.83	10.83	10.83	10.83	10.83	10.83	10.83
Pathogen	cfu/100 mL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Generic constituent	user defined	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Alkalinity	mgCaCO3/L	105.00	105.00	105.00	105.00	105.00	105.00	105.00	105.00	105.00
pH	s.u.	9.20	9.20	9.20	9.20	9.20	9.20	9.20	9.20	9.20
Downstream Boundary Water Quality (optional)	***Units***	***12:00 AM***	***1:00 AM***	***2:00 AM***	***3:00 AM***	***4:00 AM***	***5:00 AM***	***6:00 AM***	***7:00 AM***	***8:00 AM***
Temperature	C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Conductivity	umhos	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Inorganic Solids	mgD/L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dissolved Oxygen	mg/L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CBODslow	mgO2/L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CBODfast	mgO2/L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Organic Nitrogen	ugN/L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NH4-Nitrogen	ugN/L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NO3-Nitrogen	ugN/L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Organic Phosphorus	ugP/L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Inorganic Phosphorus (SRP)	ugP/L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Phytoplankton	ugA/L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Detritus (POM)	mgD/L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pathogen	cfu/100 mL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Generic constituent	user defined	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Alkalinity	mgCaCO3/L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
pH	s.u.	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00

QUAL2Kw

Stream Water Quality Model

Lake Palourde (7/16/2006)

Reach Data:

Reach for diel plot:	2							
			Reach			*Downstream*	*Elevation*	
Reach	*Downstream*		*length*	*Downstream*		*location*	*Upstream*	*Downstream*
Label	*end of reach label*	*Number*	*(km)*	*Latitude*	*Longitude*	*(km)*	*(m)*	*(m)*
	Headwater	0		29.75	91.12	7.500		1.000
Lake Palourde 1		1	0.10	29.73	91.13	7.400	1.000	1.000
Lake Palourde 2		2	7.40	29.71	91.12	0.000	1.000	1.000

								Hydraulic Model (Weir Overrides Rating Curves; F			
Downstream						*Weir*		Rating Curves			
Latitude			*Longitude*			*Height*	*Width*	*Velocity*		Depth	
Degrees	*Minutes*	*Seconds*	*Degrees*	*Minutes*	*Seconds*	*(m)*	*(m)*	*Coefficient*	*Exponent*	*Coefficient*	*Exponent*
29	45	10	91	7	7	0.0000	0.000	0.0001	1.000	1.0000	0.000
29	44	3	91	7	40	0.0000	0.000	0.0001	1.000	1.0000	0.000
29	42	42	91.00	7	19	0.0000	0.000	0.0001	1.000	1.0000	0.000

Rating Curves Override Manning Formula)										
Manning Formula					Prescribed	Bottom	Bottom	Prescribed	Prescribed	Prescribed
Channel	Manning	Bot Width	Side	Side	Dispersion	Algae	SOD	SOD	CH4 flux	NH4 flux
Slope	n	m	Slope	Slope	m2/s	Coverage	Coverage	gO2/m2/d	gO2/m2/d	mgN/m2/d
0.00	0	0.0000	0.00	0.0000	0.000					
0.00	0	0.0000	0.00	0.0000	0.000	100%	100%	-0.77	0.3800	91.6400
0.00	0	0.0000	0.00	0.0000	0.000	100%	100%	-0.77	0.3800	91.6400

Prescribed	Sediment	Sediment	Sediment/hyporheic	Hyporheic	Hyporheic
Inorg P flux	thermal cond	thermal diff	zone thickness	exchange flow	sediment porosity
mgP/m2/d	(W/m/degC)	(cm^2/sec)	(cm)	(fraction of stream flow)	(fraction of volume)
0.0000	1.6	0.0064	10	0%	40%
0.0000	1.6	0.0064	10	0%	40%

QUAL2Kw

Stream Water Quality Model

Lake Palourde (7/16/2006)

Air Temperature Data:

				Upstream	Downstream	12:00 AM	1:00 AM	2:00 AM	3:00 AM
Upstream	Reach	Downstream	Reach	Distance	Distance	Hourly air temperature for each reach (degrees C)			
Label	Label	Label	Number	km	km	(The input values are applied as point estimates at			
Headwater	Lake Palourde 1		1	7.50	7.40	28.85	27.70	26.82	26.23
	Lake Palourde 2		2	7.40	0.00	28.85	27.70	26.82	26.23

4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM
t each time. Linear interpolation is used to estimate values between the hourly inputs.)											
25.92	25.82	25.91	26.23	26.80	27.68	28.83	30.15	31.47	32.63	33.51	34.10
25.92	25.82	25.91	26.23	26.80	27.68	28.83	30.15	31.47	32.63	33.51	34.10

4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM	10:00 PM	11:00 PM
34.41	34.51	34.42	34.11	33.54	32.66	31.51	30.19
34.41	34.51	34.42	34.11	33.54	32.66	31.51	30.19

QUAL2Kw

Stream Water Quality Model

Lake Palourde (7/16/2006)

Dew Point Temperature Data:

				Upstream	Downstream	12:00 AM	1:00 AM	2:00 AM	3:00 AM
Upstream	Reach	Downstream	Reach	Distance	Distance	Hourly dewpoint temperature for each reach (degr			
Label	Label	Label	Number	km	km	(The input values are applied as point estimates a			
Headwater	Lake Palourde 1		1	7.50	7.40	25.39	24.38	23.60	23.08
	Lake Palourde 2		2	7.40	0.00	25.39	24.38	23.60	23.08

4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM
rees C)											
t each time. Linear interpolation is used to estimate values between the hourly inputs.)											
22.81	22.72	22.80	23.08	23.58	24.36	25.37	26.53	27.69	28.71	29.49	30.01
22.81	22.72	22.80	23.08	23.58	24.36	25.37	26.53	27.69	28.71	29.49	30.01

4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM	10:00 PM	11:00 PM
30.28	30.37	30.29	30.02	29.52	28.74	27.73	26.57
30.28	30.37	30.29	30.02	29.52	28.74	27.73	26.57

QUAL2Kw

Stream Water Quality Model

Lake Palourde (7/16/2006)

Wind Speed Data:

				Upstream	Downstream	12:00 AM	1:00 AM	2:00 AM	3:00 AM
Upstream	Reach	Downstream	Reach	Distance	Distance	Wind speed for each reach 7m above water surfac			
Label	Label	Label	Number	km	km	(The input values are applied as point estimates a			
Headwater	Lake Palourde 1		1	7.50	7.40	1.43	1.43	1.43	1.43
	Lake Palourde 2		2	7.40	0.00	1.43	1.43	1.43	1.43

4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM
e (m/s)											
t each time. Linear interpolation is used to estimate values between the hourly inputs.)											
1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43
1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43

4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM	10:00 PM	11:00 PM
1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43
1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43

QUAL2Kw

Stream Water Quality Model

Lake Palourde (7/16/2006)

Cloud Cover Data:

				Upstream	Downstream	12:00 AM	1:00 AM	2:00 AM	3:00 AM
Upstream	Reach	Downstream	Reach	Distance	Distance	Hourly cloud cover shade for each reach (Percent			
Label	Label	Label	Number	km	km	(Percent of sky that is covered by clouds. The inp			
Headwater	Lake Palourde 1		1	7.50	7.40	15.0%	15.0%	15.0%	15.0%
	Lake Palourde 2		2	7.40	0.00	15.0%	15.0%	15.0%	15.0%

4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM
)											
ut values are applied as point estimates at each time. Linear interpolation is used to estimate values between the hourly inputs.)											
15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%
15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%

4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM	10:00 PM	11:00 PM
15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%
15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%

QUAL2Kw

Stream Water Quality Model

Lake Palourde (7/16/2006)

Light Parameters and Surface Heat Transfer Models:

Parameter	*Value*	*Unit*	
Photosynthetically Available Radiation	**0.47**		
Background light extinction	**0.2**	*/m*	k_{eb}
Linear chlorophyll light extinction	**0.0088**	*1/m-(ugA/L)*	α_p
Nonlinear chlorophyll light extinction	**0.054**	*1/m-(ugA/L)$^{2/3}$*	α_{pn}
ISS light extinction	**0.052**	*1/m-(mgD/L)*	α_i
Detritus light extinction	**0.174**	*1/m-(mgD/L)*	α_o
Macrophyte light extinction	**0**	*1/m-(gD/m^3)*	α_{mac}
Solar shortwave radiation model			
Atmospheric attenuation model for solar	**Bras**		
Bras solar parameter (used if Bras solar model is selected)			
atmospheric turbidity coefficient (2=clear, 5=smoggy, default=2)	**4**		n_{fac}
Ryan-Stolzenbach solar parameter (used if Ryan-Stolzenbach solar model is selected)			
atmospheric transmission coefficient (0.70-0.91, default 0.8)	**0.8**		a_{tc}
Downwelling atmospheric longwave IR radiation			
atmospheric longwave emissivity model	**Koberg**		
Evaporation and air convection/conduction			
wind speed function for evaporation and air convection/conduction	**Adams 1**		

QUAL2Kw

Stream Water Quality Model

Lake Palourde (7/16/2006)

Diffuse Source Data:

Name	Up (km)	Down (km)	Diffuse Abstraction m3/s	Diffuse Inflow m3/s	Temp C	Spec Cond umhos	Inorg SS mgD/L	Diss Oxygen mg/L	CBOD slow mgO2/L	CBOD fast mgO2/L
Nonpoint Sources	7.50	0.00	0.0000	0.0043	32.40	384.00	14.17	8.61	0.00	0.00

Organic N ugN/L	Ammon N ugN/L	Nitrate N ugN/L	Organic P ugP/L	Inorganic P ugP/L	Phyto plankton ug/L	Detritus mgD/L	Pathogen cful/100 mL	Generic constituent user defined	Alk mgCaCO3/L	pH
7000000.00	50.00	20.00	7200000.00	10000000.00	66.50	10.83	0.00	0.00	105.00	9.20

QUAL2Kw

Stream Water Quality Model

Lake Palourde (7/16/2006)

Global rate parameters

Parameter	*Value*	*Units*	*Symbol*
Stoichiometry:			
Carbon	40	gC	gC
Nitrogen	7.2	gN	gN
Phosphorus	1	gP	gP
Dry weight	100	gD	gD
Chlorophyll	0.5	gA	gA
Inorganic suspended solids:			
Settling velocity	0	m/d	v_i
Oxygen:			
Reaeration model	Internal		
Temp correction	1.024		θ_a
Reaeration wind effect	Wanninkhof		
O2 for carbon oxidation	2.69	gO_2/gC	r_{oc}
O2 for NH4 nitrification	4.57	gO_2/gN	r_{on}
Oxygen inhib model CBOD oxidation	Exponential		
Oxygen inhib parameter CBOD oxidation	0.60	L/mgO2	K_{socf}
Oxygen inhib model nitrification	Exponential		
Oxygen inhib parameter nitrification	0.60	L/mgO2	K_{sona}
Oxygen enhance model denitrification	Exponential		
Oxygen enhance parameter denitrification	0.60	L/mgO2	K_{sodn}
Oxygen inhib model phyto resp	Exponential		
Oxygen inhib parameter phyto resp	0.60	L/mgO2	K_{sop}
Oxygen enhance model bot alg resp	Exponential		
Oxygen enhance parameter bot alg resp	0.60	L/mgO2	K_{sob}
Slow CBOD:			
Hydrolysis rate	0.6	/d	k_{hc}
Temp correction	1.047		θ_{hc}
Oxidation rate	0	/d	k_{dcs}
Temp correction	1.047		θ_{dcs}
Fast CBOD:			
Oxidation rate	0.9	/d	k_{dc}
Temp correction	1.047		θ_{dc}
Organic N:			
Hydrolysis	0.01	/d	k_{hn}
Temp correction	1.07		θ_{hn}
Settling velocity	0	m/d	v_{on}
Ammonium:			
Nitrification	2	/d	k_{na}
Temp correction	1.07		θ_{na}
Nitrate:			
Denitrification	0.06	/d	k_{dn}
Temp correction	1.07		θ_{dn}
Sed denitrification transfer coeff	0.03	m/d	v_{di}
Temp correction	1.07		θ_{di}
Organic P:			
Hydrolysis	0.06	/d	k_{hp}
Temp correction	1.07		θ_{hp}
Settling velocity	0	m/d	v_{op}

QUAL2Kw

Stream Water Quality Model

Lake Palourde (7/16/2006)

Global rate parameters

Inorganic P:			
Settling velocity	**0**	**m/d**	v_{ip}
Sed P oxygen attenuation half sat constant	**1.7**	**mgO_2/L**	k_{spi}
Phytoplankton:			
Max Growth rate	**5**	**/d**	k_{gp}
Temp correction	**1.07**		θ_{gp}
Respiration rate	**0.1**	**/d**	k_{rp}
Temp correction	**1.07**		θ_{rp}
Death rate	**0**	**/d**	k_{dp}
Temp correction	**1.07**		θ_{dp}
Nitrogen half sat constant	**60**	**ugN/L**	k_{sPp}
Phosphorus half sat constant	**25**	**ugP/L**	k_{sNp}
Inorganic carbon half sat constant	**1.30E-05**	**moles/L**	k_{sCp}
Phytoplankton use HCO3- as substrate	**Yes**		
Light model	**Steele**		
Light constant	**200**	**langleys/d**	K_{Lp}
Ammonia preference	**25**	**ugN/L**	k_{hnxp}
Settling velocity	**0.7**	**m/d**	v_a
Detritus (POM):			
Dissolution rate	**0.003**	**/d**	k_{dt}
Temp correction	**1.07**		θ_{dt}
Settling velocity	**0**	**m/d**	v_{dt}
pH:			
Partial pressure of carbon dioxide	**375**	**ppm**	p_{CO2}

QUAL2Kw (version 5.1)

Stream Water Quality Model

Greg Pelletier, Steve Chapra, and Hua Tao

Department of Ecology and Tufts University

System ID:		
River name	Lake Palourde	
Saved file name	Palourde-Sept-calib2	
Directory where the input/output files are saved	ch\qual2k\qual2kw\qual2kw\v51b37\palourde	
Month	9	
Day	26	
Year	2006	
Time zone	Central	
Daylight savings time	Yes	
Simulation and output options:		
Calculation step	11.25	minutes
Number of days	2000	days
Solution method (integration)	Euler	
Solution method (pH)	Newton-Raphson	
Simulate hyporheic exchange and pore water quality	No	
Display dynamic diel output	Yes	
State variables for simulation	All	
Simulate sediment diagenesis	Yes	
Program determined calc step	11.25	minutes
Time elapsed during last model run	0.50	minutes
Time of sunrise	6:55 AM	
Time of solar noon	12:55 PM	
Time of sunset	6:56 PM	
Photoperiod	12.02	hours

QUAL2Kw

Stream Water Quality Model

Lake Palourde (9/26/2006)

Headwater and Downstream Boundary Data:

Headwater Flow	51.940	m3/s								
Prescribed downstream boundary?	Yes									
Headwater Water Quality	***Units***	***12:00 AM***	***1:00 AM***	***2:00 AM***	***3:00 AM***	***4:00 AM***	***5:00 AM***	***6:00 AM***	***7:00 AM***	***8:00 AM***
Temperature	C	26.30	26.30	26.30	26.30	26.30	26.30	26.30	26.30	26.30
Conductivity	umhos	411.00	411.00	411.00	411.00	411.00	411.00	411.00	411.00	411.00
Inorganic Solids	mgD/L	21.10	21.10	21.10	21.10	21.10	21.10	21.10	21.10	21.10
Dissolved Oxygen	mg/L	7.74	7.74	7.74	7.74	7.74	7.74	7.74	7.74	7.74
CBODslow	mgO2/L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CBODfast	mgO2/L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Organic Nitrogen	ugN/L	1766.00	1766.00	1766.00	1766.00	1766.00	1766.00	1766.00	1766.00	1766.00
NH4-Nitrogen	ugN/L	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
NO3-Nitrogen	ugN/L	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
Organic Phosphorus	ugP/L	176.70	176.70	176.70	176.70	176.70	176.70	176.70	176.70	176.70
Inorganic Phosphorus (SRP)	ugP/L	88.30	88.30	88.30	88.30	88.30	88.30	88.30	88.30	88.30
Phytoplankton	ugA/L	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
Detritus (POM)	mgD/L	11.40	11.40	11.40	11.40	11.40	11.40	11.40	11.40	11.40
Pathogen	cfu/100 mL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Generic constituent	user defined	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Alkalinity	mgCaCO3/L	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00
pH	s.u.	8.80	8.80	8.80	8.80	8.80	8.80	8.80	8.80	8.80
Downstream Boundary Water Quality (optional)	***Units***	***12:00 AM***	***1:00 AM***	***2:00 AM***	***3:00 AM***	***4:00 AM***	***5:00 AM***	***6:00 AM***	***7:00 AM***	***8:00 AM***
Temperature	C									
Conductivity	umhos									
Inorganic Solids	mgD/L									
Dissolved Oxygen	mg/L									
CBODslow	mgO2/L									
CBODfast	mgO2/L									
Organic Nitrogen	ugN/L									
NH4-Nitrogen	ugN/L									
NO3-Nitrogen	ugN/L									
Organic Phosphorus	ugP/L									
Inorganic Phosphorus (SRP)	ugP/L									
Phytoplankton	ugA/L									
Detritus (POM)	mgD/L									
Pathogen	cfu/100 mL									
Generic constituent	user defined									
Alkalinity	mgCaCO3/L									
pH	s.u.	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00

QUAL2Kw

Stream Water Quality Model

Lake Palourde (9/26/2006)

Reach Data:

Reach for diel plot:	2							
			Reach			*Downstream*	*Elevation*	
Reach	*Downstream*		*length*	*Downstream*		*location*	*Upstream*	*Downstream*
Label	*end of reach label*	*Number*	*(km)*	*Latitude*	*Longitude*	*(km)*	*(m)*	*(m)*
	Headwater	0		29.75	91.12	7.500		1.000
Lake Palourde 1		1	0.10	29.73	91.13	7.400	1.000	1.000
Lake Palourde 2		2	7.40	29.71	91.12	0.000	1.000	1.000

								Hydraulic Model (Weir Overrides Rating Curves; F			
Downstream						*Weir*		Rating Curves			
Latitude			*Longitude*			*Height*	*Width*	*Velocity*		Depth	
Degrees	*Minutes*	*Seconds*	*Degrees*	*Minutes*	*Seconds*	*(m)*	*(m)*	*Coefficient*	*Exponent*	*Coefficient*	*Exponent*
29	45	10	91	7	7	0.0000	0.000	0.0001	1.000	2.0000	0.000
29	44	3	91	7	40	0.0000	0.000	0.0001	1.000	2.0000	0.000
29	42	42	91.00	7	19	0.0000	0.000	0.0001	1.000	2.0000	0.000

Rating Curves Override Manning Formula)										
Manning Formula					Prescribed	Bottom	Bottom	Prescribed	Prescribed	Prescribed
Channel	Manning	Bot Width	Side	Side	Dispersion	Algae	SOD	SOD	CH4 flux	NH4 flux
Slope	n	m	Slope	Slope	m2/s	Coverage	Coverage	gO2/m2/d	gO2/m2/d	mgN/m2/d
0.00	0	0.0000	0.00	0.0000	0.000					
0.00	0	0.0000	0.00	0.0000	0.000	0%	100%	0.00	0.0000	0.0000
0.00	0	0.0000	0.00	0.0000	0.000	0%	100%	0.00	0.0000	0.0000

Sediment	Sediment	Sediment/hyporheic	Hyporheic	Hyporheic
thermal cond	thermal diff	zone thickness	exchange flow	sediment porosity
(W/m/degC)	(cm^2/sec)	(cm)	(fraction of stream flow)	(fraction of volume)
1.6	0.0064	10	0%	40%
1.6	0.0064	10	0%	40%

QUAL2Kw

Stream Water Quality Model

Lake Palourde (9/26/2006)

Air Temperature Data:

				Upstream	Downstream	12:00 AM	1:00 AM	2:00 AM	3:00 AM
Upstream	Reach	Downstream	Reach	Distance	Distance	Hourly air temperature for each reach (degrees C)			
Label	Label	Label	Number	km	km	(The input values are applied as point estimates a			
Headwater	Lake Palourde 1		1	7.50	7.40	19.88	18.30	16.93	15.89
	Lake Palourde 2		2	7.40	0.00	19.88	18.30	16.93	15.89

4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM
t each time. Linear interpolation is used to estimate values between the hourly inputs.)											
15.23	15.00	15.22	15.87	16.91	18.27	19.85	21.55	23.25	24.84	26.21	27.26
15.23	15.00	15.22	15.87	16.91	18.27	19.85	21.55	23.25	24.84	26.21	27.26

4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM	10:00 PM	11:00 PM
27.92	28.15	27.93	27.28	26.24	24.89	23.31	21.61
27.92	28.15	27.93	27.28	26.24	24.89	23.31	21.61

QUAL2Kw

Stream Water Quality Model

Lake Palourde (9/26/2006)

Dew Point Temperature Data:

				Upstream	Downstream	12:00 AM	1:00 AM	2:00 AM
Upstream	Reach	Downstream	Reach	Distance	Distance	Hourly dewpoint temperature for eac		
Label	Label	Label	Number	km	km	(The input values are applied as poin		
Headwater	Lake Palourde 1		1	7.50	7.40	15.71	14.46	13.37
	Lake Palourde 2		2	7.40	0.00	15.71	14.46	13.37

3:00 AM	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM
h reach (degrees C)										
t estimates at each time. Linear interpolation is used to estimate values between the hourly inputs.)										
12.55	12.03	11.85	12.02	12.54	13.36	14.43	15.68	17.02	18.37	19.62
12.55	12.03	11.85	12.02	12.54	13.36	14.43	15.68	17.02	18.37	19.62

2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM	10:00 PM	11:00 PM
20.71	21.54	22.06	22.24	22.06	21.55	20.73	19.66	18.41	17.07
20.71	21.54	22.06	22.24	22.06	21.55	20.73	19.66	18.41	17.07

QUAL2Kw

Stream Water Quality Model

Lake Palourde (9/26/2006)

Wind Speed Data:

				Upstream	Downstream	12:00 AM	1:00 AM	2:00 AM
Upstream	Reach	Downstream	Reach	Distance	Distance	Wind speed for each reach 7m above		
Label	Label	Label	Number	km	km	(The input values are applied as poin		
Headwater	Lake Palourde 1		1	7.50	7.40	2.02	2.02	2.02
	Lake Palourde 2		2	7.40	0.00	2.02	2.02	2.02

3:00 AM	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM
water surface (m/s)										
t estimates at each time. Linear interpolation is used to estimate values between the hourly inputs.)										
2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02
2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02

2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM	10:00 PM	11:00 PM
2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02
2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02

QUAL2Kw

Stream Water Quality Model

Lake Palourde (9/26/2006)

Cloud Cover Data:

				Upstream	Downstream	12:00 AM	1:00 AM	2:00 AM
Upstream	Reach	Downstream	Reach	Distance	Distance	Hourly cloud cover shade for each re		
Label	Label	Label	Number	km	km	(Percent of sky that is covered by clo		
Headwater	Lake Palourde 1		1	7.50	7.40	3.0%	3.0%	3.0%
	Lake Palourde 2		2	7.40	0.00	3.0%	3.0%	3.0%

3:00 AM	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM
ach (Percent)										
uds. The input values are applied as point estimates at each time. Linear interpolation is used to estimate values between the hourly inpu										
3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%

2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM	10:00 PM	11:00 PM
ts.)									
3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%

QUAL2Kw

Stream Water Quality Model

Lake Palourde (9/26/2006)

Light Parameters and Surface Heat Transfer Models:

Parameter	*Value*	*Unit*	
Photosynthetically Available Radiation	0.47		
Background light extinction	0.2	/m	k_{eb}
Linear chlorophyll light extinction	0.0088	1/m-(ugA/L)	α_p
Nonlinear chlorophyll light extinction	0.054	$1/m\text{-}(ugA/L)^{2/3}$	α_{pn}
ISS light extinction	0.052	1/m-(mgD/L)	α_i
Detritus light extinction	0.174	1/m-(mgD/L)	α_o
Macrophyte light extinction	0	$1/m\text{-}(gD/m^3)$	α_{mac}
Solar shortwave radiation model			
Atmospheric attenuation model for solar	Bras		
Bras solar parameter (used if Bras solar model is selected)			
atmospheric turbidity coefficient (2=clear, 5=smoggy, default=2)	4		n_{fac}
Ryan-Stolzenbach solar parameter (used if Ryan-Stolzenbach solar model is selected)			
atmospheric transmission coefficient (0.70-0.91, default 0.8)	0.8		a_{tc}
Downwelling atmospheric longwave IR radiation			
atmospheric longwave emissivity model	Koberg		
Evaporation and air convection/conduction			
wind speed function for evaporation and air convection/conduction	Adams 1		

QUAL2Kw

Stream Water Quality Model

Lake Palourde (9/26/2006)

Diffuse Source Data:

			Diffuse	Diffuse		Spec	Inorg	Diss	CBOD	CBOD
			Abstraction	Inflow	Temp	Cond	SS	Oxygen	slow	fast
Name	Up (km)	Down (km)	m3/s	m3/s	C	umhos	mgD/L	mg/L	mgO2/L	mgO2/L
	7.50	0.00	0.0000	0.0043	26.50	411.00	21.10	7.74	0.00	0.00

Organic	Ammon	Nitrate	Organic	Inorganic	Phyto			Generic		
N	N	N	P	P	plankton	Detritus	Pathogen	constituent	Alk	pH
ugN/L	ugN/L	ugN/L	ugP/L	ugP/L	ug/L	mgD/L	cfu/100 mL	user defined	mgCaCO3/L	
7000000.00	50.00	20.00	5000000.00	2000000.00	50.00	11.40	0.00	0.0	120.00	8.80

QUAL2Kw

Stream Water Quality Model

Lake Palourde (9/26/2006)

Global rate parameters

Parameter	*Value*	*Units*	*Symbol*
Stoichiometry:			
Carbon	40	gC	gC
Nitrogen	7.2	gN	gN
Phosphorus	1	gP	gP
Dry weight	100	gD	gD
Chlorophyll	0.5	gA	gA
Inorganic suspended solids:			
Settling velocity	0	m/d	v_i
Oxygen:			
Reaeration model	Internal		
Temp correction	1.024		θ_a
Reaeration wind effect	Wanninkhof		
O2 for carbon oxidation	2.69	gO_2/gC	r_{oc}
O2 for NH4 nitrification	4.57	gO_2/gN	r_{on}
Oxygen inhib model CBOD oxidation	Exponential		
Oxygen inhib parameter CBOD oxidation	0.60	L/mgO2	K_{socf}
Oxygen inhib model nitrification	Exponential		
Oxygen inhib parameter nitrification	0.60	L/mgO2	K_{sona}
Oxygen enhance model denitrification	Exponential		
Oxygen enhance parameter denitrification	0.60	L/mgO2	K_{sodn}
Oxygen inhib model phyto resp	Exponential		
Oxygen inhib parameter phyto resp	0.60	L/mgO2	K_{sop}
Oxygen enhance model bot alg resp	Exponential		
Oxygen enhance parameter bot alg resp	0.60	L/mgO2	K_{sob}
Slow CBOD:			
Hydrolysis rate	0.6	/d	k_{hc}
Temp correction	1.047		θ_{hc}
Oxidation rate	0	/d	k_{dcs}
Temp correction	1.047		θ_{dcs}
Fast CBOD:			
Oxidation rate	0.9	/d	k_{dc}
Temp correction	1.047		θ_{dc}
Organic N:			
Hydrolysis	0.01	/d	k_{hn}
Temp correction	1.07		θ_{hn}
Settling velocity	0	m/d	v_{on}
Ammonium:			
Nitrification	2	/d	k_{na}
Temp correction	1.07		θ_{na}
Nitrate:			
Denitrification	0.06	/d	k_{dn}
Temp correction	1.07		θ_{dn}
Sed denitrification transfer coeff	0.03	m/d	v_{di}
Temp correction	1.07		θ_{di}
Organic P:			
Hydrolysis	0.06	/d	k_{hp}
Temp correction	1.07		θ_{hp}
Settling velocity	0	m/d	v_{op}

QUAL2Kw

Stream Water Quality Model

Lake Palourde (9/26/2006)

Global rate parameters

Inorganic P:			
Settling velocity	**0**	**m/d**	v_{ip}
Sed P oxygen attenuation half sat constant	**1.7**	**mgO_2/L**	k_{spi}
Phytoplankton:			
Max Growth rate	**5**	**/d**	k_{gp}
Temp correction	**1.07**		θ_{gp}
Respiration rate	**0.1**	**/d**	k_{rp}
Temp correction	**1.07**		θ_{rp}
Death rate	**0**	**/d**	k_{dp}
Temp correction	**1.07**		θ_{dp}
Nitrogen half sat constant	**60**	**ugN/L**	k_{sPp}
Phosphorus half sat constant	**25**	**ugP/L**	k_{sNp}
Inorganic carbon half sat constant	**1.30E-05**	**moles/L**	k_{sCp}
Phytoplankton use HCO3- as substrate	**Yes**		
Light model	**Steele**		
Light constant	**200**	**langleys/d**	K_{Lp}
Ammonia preference	**25**	**ugN/L**	k_{hnxp}
Settling velocity	**0.55**	**m/d**	v_a
Detritus (POM):			
Dissolution rate	**0.003**	**/d**	k_{dt}
Temp correction	**1.07**		θ_{dt}
Settling velocity	**0**	**m/d**	v_{dt}
pH:			
Partial pressure of carbon dioxide	**375**	**ppm**	p_{CO2}

QUAL2Kw (version 5.1)

Stream Water Quality Model

Greg Pelletier, Steve Chapra, and Hua Tao

Department of Ecology and Tufts University

System ID:		
River name	Bayou Avoca	
Saved file name	Avoca-July_calibration	
Directory where the input/output files are saved	ual2k\qual2kw\qual2kw\v51b37\Chene-Avoca	
Month	7	
Day	16	
Year	2006	
Time zone	Central	
Daylight savings time	No	
Simulation and output options:		
Calculation step	11.25	minutes
Number of days	2000	days
Solution method (integration)	Euler	
Solution method (pH)	Newton-Raphson	
Simulate hyporheic exchange and pore water quality	No	
Display dynamic diel output	Yes	
State variables for simulation	All	
Simulate sediment diagenesis	Yes	
Program determined calc step	11.25	minutes
Time elapsed during last model run	0.52	minutes
Time of sunrise	5:15 AM	
Time of solar noon	12:11 PM	
Time of sunset	7:06 PM	
Photoperiod	13.84	hours

QUAL2Kw

Stream Water Quality Model

Bayou Avoca (7/16/2006)

Headwater and Downstream Boundary Data:

Headwater Flow	5.012	m3/s								
Prescribed downstream boundary?	No									
Headwater Water Quality	*Units*	*12:00 AM*	*1:00 AM*	*2:00 AM*	*3:00 AM*	*4:00 AM*	*5:00 AM*	*6:00 AM*	*7:00 AM*	*8:00 AM*
Temperature	C	31.04	31.04	31.04	31.04	31.04	31.04	31.04	31.04	31.04
Conductivity	umhos	458.00	458.00	458.00	458.00	458.00	458.00	458.00	458.00	458.00
Inorganic Solids	mgD/L	6.38	6.38	6.38	6.38	6.38	6.38	6.38	6.38	6.38
Dissolved Oxygen	mg/L	7.97	7.97	7.97	7.97	7.97	7.97	7.97	7.97	7.97
CBODslow	mgO2/L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CBODfast	mgO2/L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Organic Nitrogen	ugN/L	1413.00	1413.00	1413.00	1413.00	1413.00	1413.00	1413.00	1413.00	1413.00
NH4-Nitrogen	ugN/L	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
NO3-Nitrogen	ugN/L	1215.00	1215.00	1215.00	1215.00	1215.00	1215.00	1215.00	1215.00	1215.00
Organic Phosphorus	ugP/L	96.70	96.70	96.70	96.70	96.70	96.70	96.70	96.70	96.70
Inorganic Phosphorus (SRP)	ugP/L	48.30	48.30	48.30	48.30	48.30	48.30	48.30	48.30	48.30
Phytoplankton	ugA/L	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00
Detritus (POM)	mgD/L	9.12	9.12	9.12	9.12	9.12	9.12	9.12	9.12	9.12
Pathogen	cfu/100 mL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Generic constituent	user defined	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Alkalinity	mgCaCO3/L	115.00	115.00	115.00	115.00	115.00	115.00	115.00	115.00	115.00
pH	s.u.	8.43	8.43	8.43	8.43	8.43	8.43	8.43	8.43	8.43
Downstream Boundary Water Quality (optional)	*Units*	*12:00 AM*	*1:00 AM*	*2:00 AM*	*3:00 AM*	*4:00 AM*	*5:00 AM*	*6:00 AM*	*7:00 AM*	*8:00 AM*
Temperature	C									
Conductivity	umhos									
Inorganic Solids	mgD/L									
Dissolved Oxygen	mg/L									
CBODslow	mgO2/L									
CBODfast	mgO2/L									
Organic Nitrogen	ugN/L									
NH4-Nitrogen	ugN/L									
NO3-Nitrogen	ugN/L									
Organic Phosphorus	ugP/L									
Inorganic Phosphorus (SRP)	ugP/L									
Phytoplankton	ugA/L									
Detritus (POM)	mgD/L									
Pathogen	cfu/100 mL									
Generic constituent	user defined									
Alkalinity	mgCaCO3/L									
pH	s.u.									

QUAL2Kw

Stream Water Quality Model

Bayou Avoca (7/16/2006)

Reach Data:

Reach for diel plot:	2							
			Reach			*Downstream*	*Elevation*	
Reach	*Downstream*		*length*	*Downstream*		*location*	*Upstream*	*Downstream*
Label	*end of reach label*	*Number*	*(km)*	*Latitude*	*Longitude*	*(km)*	*(m)*	*(m)*
	Headwater					23.000		1.000
Bayou Avoca 1						22.900	1.000	1.000
Bayou Avoca 2						0.000	1.000	1.000

						Hydraulic Model (Weir Overrides Rating Curves; F					
Downstream						*Weir*		Rating Curves			
Latitude			*Longitude*			*Height*	*Width*	*Velocity*		Depth	
Degrees	*Minutes*	*Seconds*	*Degrees*	*Minutes*	*Seconds*	*(m)*	*(m)*	*Coefficient*	*Exponent*	*Coefficient*	*Exponent*
29	37	36	91	4	58	0.0000	0.000	0.0006	1.000	3.6576	0.00
29	37	36	91	4	58	0.0000	0.000	0.0006	1.000	3.6576	0.00
29	32	24	91	14	54	0.0000	0.000	0.0006	1.000	3.6576	0.00

Rating Curves Override Manning Formula)										
Manning Formula					Prescribed	Bottom	Bottom	Prescribed	Prescribed	Prescribed
Channel	Manning	Bot Width	Side	Side	Dispersion	Algae	SOD	SOD	CH4 flux	NH4 flux
Slope	n	m	Slope	Slope	m2/s	Coverage	Coverage	gO2/m2/d	gO2/m2/d	mgN/m2/d
0.00	0	0.0000	0.00	0.0000	0.000					
0.00	0	0.0000	0.00	0.0000	0.000	0%	100%	0.00	0.0000	0.0000
0.00	0	0.0000	0.00	0.0000	0.000	0%	100%	0.00	0.0000	0.0000

Prescribed	Sediment	Sediment	Sediment/hyporheic	Hyporheic	Hyporheic
Inorg P flux	thermal cond	thermal diff	zone thickness	exchange flow	sediment porosity
mgP/m2/d	(W/m/degC)	(cm^2/sec)	(cm)	(fraction of stream flow)	(fraction of volume)
0.0000	1.6	0.0064	10	0%	40%
0.0000	1.6	0.0064	10	0%	40%

QUAL2Kw

Stream Water Quality Model

Bayou Avoca (7/16/2006)

Air Temperature Data:

				Upstream	Downstream	12:00 AM	1:00 AM	2:00 AM
Upstream	Reach	Downstream	Reach	Distance	Distance	Hourly air temperature for each reach		
Label	Label	Label	Number	km	km	(The input values are applied as poin		
Headwater	Bayou Avoca 1		1	23.00	22.90	28.85	27.70	26.82
	Bayou Avoca 2		2	22.90	0.00	28.85	27.70	26.82

3:00 AM	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM
(degrees C)										
t estimates at each time. Linear interpolation is used to estimate values between the hourly inputs.)										
26.23	25.92	25.82	25.91	26.23	26.80	27.68	28.83	30.15	31.47	32.63
26.23	25.92	25.82	25.91	26.23	26.80	27.68	28.83	30.15	31.47	32.63

2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM	10:00 PM	11:00 PM
33.51	34.10	34.41	34.51	34.42	34.11	33.54	32.66	31.51	30.19
33.51	34.10	34.41	34.51	34.42	34.11	33.54	32.66	31.51	30.19

QUAL2Kw

Stream Water Quality Model

Bayou Avoca (7/16/2006)

Dew Point Temperature Data: -3

				Upstream	Downstream	12:00 AM	1:00 AM	2:00 AM
Upstream	Reach	Downstream	Reach	Distance	Distance	Hourly dewpoint temperature for eac		
Label	Label	Label	Number	km	km	(The input values are applied as poin		
Headwater	Bayou Avoca 1		1	23.00	22.90	15.18	14.45	13.90
	Bayou Avoca 2		2	22.90	0.00	15.18	14.45	13.90

3:00 AM	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM
h reach (degrees C)										
t estimates at each time. Linear interpolation is used to estimate values between the hourly inputs.)										
13.52	13.33	13.27	13.32	13.52	13.88	14.44	15.16	15.99	16.83	17.56
13.52	13.33	13.27	13.32	13.52	13.88	14.44	15.16	15.99	16.83	17.56

2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM	10:00 PM	11:00 PM
18.11	18.48	18.68	18.74	18.68	18.49	18.13	17.58	16.85	16.02
18.11	18.48	18.68	18.74	18.68	18.49	18.13	17.58	16.85	16.02

QUAL2Kw

Stream Water Quality Model

Bayou Avoca (7/16/2006)

Wind Speed Data:

				Upstream	Downstream	12:00 AM	1:00 AM	2:00 AM
Upstream	Reach	Downstream	Reach	Distance	Distance	Wind speed for each reach 7m above		
Label	Label	Label	Number	km	km	(The input values are applied as poin		
Headwater	Bayou Avoca 1		1	23.00	22.90	1.43	1.43	1.43
	Bayou Avoca 2		2	22.90	0.00	1.43	1.43	1.43

3:00 AM	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM
water surface (m/s)										
t estimates at each time. Linear interpolation is used to estimate values between the hourly inputs.)										
1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43
1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43

2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM	10:00 PM	11:00 PM
1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43
1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43

QUAL2Kw

Stream Water Quality Model

Bayou Avoca (7/16/2006)

Cloud Cover Data:

				Upstream	Downstream	12:00 AM	1:00 AM	2:00 AM
Upstream	Reach	Downstream	Reach	Distance	Distance	Hourly cloud cover shade for each re		
Label	Label	Label	Number	km	km	(Percent of sky that is covered by clo		
Headwater	Bayou Avoca 1		1	23.00	22.90	15.0%	15.0%	15.0%
	Bayou Avoca 2		2	22.90	0.00	15.0%	15.0%	15.0%

3:00 AM	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM
ach (Percent)										
uds. The input values are applied as point estimates at each time. Linear interpolation is used to estimate values between the hourly inpu										
15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%
15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%

2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM	10:00 PM	11:00 PM
ts.)									
15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%
15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%

QUAL2Kw

Stream Water Quality Model

Bayou Avoca (7/16/2006)

Light Parameters and Surface Heat Transfer Models:

Parameter	*Value*	*Unit*	
Photosynthetically Available Radiation	**0.47**		
Background light extinction	**0.2**	*/m*	k_{eb}
Linear chlorophyll light extinction	**0.0088**	*1/m-(ugA/L)*	α_p
Nonlinear chlorophyll light extinction	**0.054**	*1/m-(ugA/L)$^{2/3}$*	α_{pn}
ISS light extinction	**0.052**	*1/m-(mgD/L)*	α_i
Detritus light extinction	**0.174**	*1/m-(mgD/L)*	α_o
Macrophyte light extinction	**0**	*1/m-(gD/m^3)*	α_{mac}
Solar shortwave radiation model			
Atmospheric attenuation model for solar	**Bras**		
Bras solar parameter (used if Bras solar model is selected)			
atmospheric turbidity coefficient (2=clear, 5=smoggy, default=2)	**4**		n_{fac}
Ryan-Stolzenbach solar parameter (used if Ryan-Stolzenbach solar model is selected)			
atmospheric transmission coefficient (0.70-0.91, default 0.8)	**0.8**		a_{tc}
Downwelling atmospheric longwave IR radiation			
atmospheric longwave emissivity model	**Koberg**		
Evaporation and air convection/conduction			
wind speed function for evaporation and air convection/conduction	**Adams 1**		

QUAL2Kw

Stream Water Quality Model

Bayou Avoca (7/16/2006)

Diffuse Source Data:

			Diffuse	Diffuse		Spec	Inorg	Diss	CBOD	CBOD
			Abstraction	Inflow	Temp	Cond	SS	Oxygen	slow	fast
Name	Up (km)	Down (km)	m3/s	m3/s	C	umhos	mgD/L	mg/L	mgO2/L	mgO2/L
	22.90	0.00	0.0000	0.0056	31.70	458.00	6.38	7.97	0.00	0.00

Organic	Ammon	Nitrate	Organic	Inorganic	Phyto			Generic		
N	N	N	P	P	plankton	Detritus	Pathogen	constituent	Alk	pH
ugN/L	ugN/L	ugN/L	ugP/L	ugP/L	ug/L	mgD/L	cfu/100 mL	user defined	mgCaCO3/L	
2600000.00	50.00	1215.00	1150000.00	48.30	40.00	25000.00	0.00	0.00	115.00	8.43

QUAL2Kw

Stream Water Quality Model

Bayou Avoca (7/16/2006)

Global rate parameters

Parameter	*Value*	*Units*	*Symbol*
Stoichiometry:			
Carbon	40	gC	gC
Nitrogen	7.2	gN	gN
Phosphorus	1	gP	gP
Dry weight	100	gD	gD
Chlorophyll	0.5	gA	gA
Inorganic suspended solids:			
Settling velocity	0	m/d	v_i
Oxygen:			
Reaeration model	Internal		
Temp correction	1.024		θ_a
Reaeration wind effect	Wanninkhof		
O2 for carbon oxidation	2.69	gO_2/gC	r_{oc}
O2 for NH4 nitrification	4.57	gO_2/gN	r_{on}
Oxygen inhib model CBOD oxidation	Exponential		
Oxygen inhib parameter CBOD oxidation	0.60	L/mgO2	K_{socf}
Oxygen inhib model nitrification	Exponential		
Oxygen inhib parameter nitrification	0.60	L/mgO2	K_{sona}
Oxygen enhance model denitrification	Exponential		
Oxygen enhance parameter denitrification	0.60	L/mgO2	K_{sodn}
Oxygen inhib model phyto resp	Exponential		
Oxygen inhib parameter phyto resp	0.60	L/mgO2	K_{sop}
Oxygen enhance model bot alg resp	Exponential		
Oxygen enhance parameter bot alg resp	0.60	L/mgO2	K_{sob}
Slow CBOD:			
Hydrolysis rate	0.6	/d	k_{hc}
Temp correction	1.047		θ_{hc}
Oxidation rate	0	/d	k_{dcs}
Temp correction	1.047		θ_{dcs}
Fast CBOD:			
Oxidation rate	0.9	/d	k_{dc}
Temp correction	1.047		θ_{dc}
Organic N:			
Hydrolysis	0.01	/d	k_{hn}
Temp correction	1.07		θ_{hn}
Settling velocity	0	m/d	v_{on}
Ammonium:			
Nitrification	2	/d	k_{na}
Temp correction	1.07		θ_{na}
Nitrate:			
Denitrification	0.06	/d	k_{dn}
Temp correction	1.07		θ_{dn}
Sed denitrification transfer coeff	0.03	m/d	v_{di}
Temp correction	1.07		θ_{di}
Organic P:			
Hydrolysis	0.06	/d	k_{hp}
Temp correction	1.07		θ_{hp}
Settling velocity	0	m/d	v_{op}

QUAL2Kw

Stream Water Quality Model

Lake Palourde (7/16/2006)

Global rate parameters

Organic P:			
Hydrolysis	**0.06**	**/d**	k_{hp}
Temp correction	**1.07**		θ_{hp}
Settling velocity	**0**	**m/d**	v_{op}
Inorganic P:			
Settling velocity	**0**	**m/d**	v_{ip}
Sed P oxygen attenuation half sat constant	**1.7**	**mgO_2/L**	k_{spi}
Phytoplankton:			
Max Growth rate	**5**	**/d**	k_{gp}
Temp correction	**1.07**		θ_{gp}
Respiration rate	**0.1**	**/d**	k_{rp}
Temp correction	**1.07**		θ_{rp}
Death rate	**0**	**/d**	k_{dp}
Temp correction	**1.07**		θ_{dp}
Nitrogen half sat constant	**60**	**ugN/L**	k_{sPp}
Phosphorus half sat constant	**25**	**ugP/L**	k_{sNp}
Inorganic carbon half sat constant	**1.30E-05**	**moles/L**	k_{sCp}
Phytoplankton use HCO3- as substrate	**Yes**		
Light model	**Steele**		
Light constant	**200**	**langleys/d**	K_{Lp}
Ammonia preference	**25**	**ugN/L**	k_{hnxp}
Settling velocity	**0.55**	**m/d**	v_a
Detritus (POM):			
Dissolution rate	**0.003**	**/d**	k_{dt}
Temp correction	**1.07**		θ_{dt}
Settling velocity	**0**	**m/d**	v_{dt}
pH:			
Partial pressure of carbon dioxide	**375**	**ppm**	p_{CO2}

QUAL2Kw (version 5.1)

Stream Water Quality Model

Greg Pelletier, Steve Chapra, and Hua Tao

Department of Ecology and Tufts University

System ID:		
River name	Bayou Avoca	
Saved file name	Avoca-Sept calibration	
Directory where the input/output files are saved		
Month	9	
Day	26	
Year	2006	
Time zone	Central	
Daylight savings time	No	
Simulation and output options:		
Calculation step	11.25	minutes
Number of days	2000	days
Solution method (integration)	Euler	
Solution method (pH)	Newton-Raphson	
Simulate hyporheic exchange and pore water quality	No	
Display dynamic diel output	Yes	
State variables for simulation	All	
Simulate sediment diagenesis	Yes	
Program determined calc step	11.25	minutes
Time elapsed during last model run	0.40	minutes
Time of sunrise	5:55 AM	
Time of solar noon	11:56 AM	
Time of sunset	5:56 PM	
Photoperiod	12.02	hours

QUAL2Kw

Stream Water Quality Model

Bayou Avoca (9/26/2006)

Headwater and Downstream Boundary Data:

Headwater Flow	5.012	m3/s								
Prescribed downstream boundary?	No									
Headwater Water Quality	*Units*	*12:00 AM*	*1:00 AM*	*2:00 AM*	*3:00 AM*	*4:00 AM*	*5:00 AM*	*6:00 AM*	*7:00 AM*	*8:00 AM*
Temperature	C	27.53	27.53	27.53	27.53	27.53	27.53	27.53	27.53	27.53
Conductivity	umhos	565.00	565.00	565.00	565.00	565.00	565.00	565.00	565.00	565.00
Inorganic Solids	mgD/L	24.38	24.38	24.38	24.38	24.38	24.38	24.38	24.38	24.38
Dissolved Oxygen	mg/L	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62
CBODslow	mgO2/L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CBODfast	mgO2/L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Organic Nitrogen	ugN/L	1268.00	1268.00	1268.00	1268.00	1268.00	1268.00	1268.00	1268.00	1268.00
NH4-Nitrogen	ugN/L	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
NO3-Nitrogen	ugN/L	255.00	255.00	255.00	255.00	255.00	255.00	255.00	255.00	255.00
Organic Phosphorus	ugP/L	146.70	146.70	146.70	146.70	146.70	146.70	146.70	146.70	146.70
Inorganic Phosphorus (SRP)	ugP/L	73.30	73.30	73.30	73.30	73.30	73.30	73.30	73.30	73.30
Phytoplankton	ugA/L	71.00	71.00	71.00	71.00	71.00	71.00	71.00	71.00	71.00
Detritus (POM)	mgD/L	9.12	9.12	9.12	9.12	9.12	9.12	9.12	9.12	9.12
Pathogen	cfu/100 mL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Generic constituent	user defined									
Alkalinity	mgCaCO3/L	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00
pH	s.u.	8.12	8.12	8.12	8.12	8.12	8.12	8.12	8.12	8.12
Downstream Boundary Water Quality (optional)	*Units*	*12:00 AM*	*1:00 AM*	*2:00 AM*	*3:00 AM*	*4:00 AM*	*5:00 AM*	*6:00 AM*	*7:00 AM*	*8:00 AM*
Temperature	C									
Conductivity	umhos									
Inorganic Solids	mgD/L									
Dissolved Oxygen	mg/L									
CBODslow	mgO2/L									
CBODfast	mgO2/L									
Organic Nitrogen	ugN/L									
NH4-Nitrogen	ugN/L									
NO3-Nitrogen	ugN/L									
Organic Phosphorus	ugP/L									
Inorganic Phosphorus (SRP)	ugP/L									
Phytoplankton	ugA/L									
Detritus (POM)	mgD/L									
Pathogen	cfu/100 mL									
Generic constituent	user defined									
Alkalinity	mgCaCO3/L									
pH	s.u.									

QUAL2Kw

Stream Water Quality Model

Bayou Avoca (9/26/2006)

Reach Data:

Reach for diel plot:	2							
			Reach			*Downstream*	*Elevation*	
Reach	*Downstream*		*length*	*Downstream*		*location*	*Upstream*	*Downstream*
Label	*end of reach label*	*Number*	*(km)*	*Latitude*	*Longitude*	*(km)*	*(m)*	*(m)*
	Headwater	0		29.63	91.08	23.000		1.000
Bayou Avoca 1		1	0.10	29.63	91.08	22.900	1.000	1.000
Bayou Avoca 2		2	22.90	29.54	91.25	0.000	1.000	1.000

						Hydraulic Model (Weir Overrides Rating Curves; F					
Downstream						*Weir*		Rating Curves			
Latitude			*Longitude*			*Height*	*Width*	*Velocity*		Depth	
Degrees	*Minutes*	*Seconds*	*Degrees*	*Minutes*	*Seconds*	*(m)*	*(m)*	*Coefficient*	*Exponent*	*Coefficient*	*Exponent*
29	37	36	91	4	58			0.0006	1.000	3.6576	0.00
29	37	36	91	4	58			0.0006	1.000	3.6576	0.00
29	32	24	91	14	54			0.0006	1.000	3.6576	0.00

Rating Curves Override Manning Formula)										
Manning Formula					Prescribed	Bottom	Bottom	Prescribed	Prescribed	Prescribed
Channel	Manning	Bot Width	Side	Side	Dispersion	Algae	SOD	SOD	CH4 flux	NH4 flux
Slope	n	m	Slope	Slope	m2/s	Coverage	Coverage	gO2/m2/d	gO2/m2/d	mgN/m2/d
0.00	0	0.0000	0.00	0.0000						
0.00	0	0.0000	0.00	0.0000	0.000	0%	100%	0.00	0.0000	0.0000
0.00	0	0.0000	0.00	0.0000	0.000	0%	100%	0.00	0.0000	0.0000

Prescribed	Sediment	Sediment	Sediment/hyporheic	Hyporheic	Hyporheic
Inorg P flux	thermal cond	thermal diff	zone thickness	exchange flow	sediment porosity
mgP/m2/d	(W/m/degC)	(cm^2/sec)	(cm)	(fraction of stream flow)	(fraction of volume)
0.0000	1.6	0.0064	10	0%	40%
0.0000	1.6	0.0064	10	0%	40%

QUAL2Kw

Stream Water Quality Model

Bayou Avoca (9/26/2006)

Air Temperature Data:

				Upstream	Downstream	12:00 AM	1:00 AM	2:00 AM
Upstream	Reach	Downstream	Reach	Distance	Distance	Hourly air temperature for each reach		
Label	Label	Label	Number	km	km	(The input values are applied as poin		
Headwater	Bayou Avoca 1		1	23.00	22.90	19.88	18.30	16.93
	Bayou Avoca 2		2	22.90	0.00	19.88	18.30	16.93

3:00 AM	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM
(degrees C)										
t estimates at each time. Linear interpolation is used to estimate values between the hourly inputs.)										
15.89	15.23	15.00	15.22	15.87	16.91	18.27	19.85	21.55	23.25	24.84
15.89	15.23	15.00	15.22	15.87	16.91	18.27	19.85	21.55	23.25	24.84

2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM	10:00 PM	11:00 PM
26.21	27.26	27.92	28.15	27.93	27.28	26.24	24.89	23.31	21.61
26.21	27.26	27.92	28.15	27.93	27.28	26.24	24.89	23.31	21.61

QUAL2Kw

Stream Water Quality Model

Bayou Avoca (9/26/2006)

Dew Point Temperature Data: 4

				Upstream	Downstream	12:00 AM	1:00 AM	2:00 AM
Upstream	Reach	Downstream	Reach	Distance	Distance	Hourly dewpoint temperature for eac		
Label	Label	Label	Number	km	km	(The input values are applied as poin		
Headwater	Bayou Avoca 1		1	23.00	22.90	23.88	22.30	20.93
	Bayou Avoca 2		2	22.90	0.00	23.88	22.30	20.93

3:00 AM	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM
h reach (degrees C)										
t estimates at each time. Linear interpolation is used to estimate values between the hourly inputs.)										
19.89	19.23	19.00	19.22	19.87	20.91	22.27	23.85	25.55	27.25	28.84
19.89	19.23	19.00	19.22	19.87	20.91	22.27	23.85	25.55	27.25	28.84

2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM	10:00 PM	11:00 PM
30.21	31.26	31.92	32.15	31.93	31.28	30.24	28.89	27.31	25.61
30.21	31.26	31.92	32.15	31.93	31.28	30.24	28.89	27.31	25.61

QUAL2Kw

Stream Water Quality Model

Bayou Avoca (9/26/2006)

Wind Speed Data:

				Upstream	Downstream	12:00 AM	1:00 AM	2:00 AM
Upstream	Reach	Downstream	Reach	Distance	Distance	Wind speed for each reach 7m above		
Label	Label	Label	Number	km	km	(The input values are applied as poin		
Headwater	Bayou Avoca 1		1	23.00	22.90	2.02	2.02	2.02
	Bayou Avoca 2		2	22.90	0.00	2.02	2.02	2.02

3:00 AM	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM
water surface (m/s)										
t estimates at each time. Linear interpolation is used to estimate values between the hourly inputs.)										
2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02
2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02

2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM	10:00 PM	11:00 PM
2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02
2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02

QUAL2Kw

Stream Water Quality Model

Bayou Avoca (9/26/2006)

Cloud Cover Data:

				Upstream	Downstream	12:00 AM	1:00 AM	2:00 AM
Upstream	Reach	Downstream	Reach	Distance	Distance	Hourly cloud cover shade for each re		
Label	Label	Label	Number	km	km	(Percent of sky that is covered by clo		
Headwater	Bayou Avoca 1		1	23.00	22.90	3.0%	3.0%	3.0%
	Bayou Avoca 2		2	22.90	0.00	3.0%	3.0%	3.0%

3:00 AM	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM
ach (Percent)										
uds. The input values are applied as point estimates at each time. Linear interpolation is used to estimate values between the hourly inpu										
3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%

2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM	10:00 PM	11:00 PM
ts.)									
3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%

QUAL2Kw

Stream Water Quality Model

Bayou Avoca (9/26/2006)

Light Parameters and Surface Heat Transfer Models:

Parameter	*Value*	*Unit*	
Photosynthetically Available Radiation	0.47		
Background light extinction	0.2	/m	k_{eb}
Linear chlorophyll light extinction	0.0088	1/m-(ugA/L)	α_p
Nonlinear chlorophyll light extinction	0.054	$1/m\text{-}(ugA/L)^{2/3}$	α_{pn}
ISS light extinction	0.052	1/m-(mgD/L)	α_i
Detritus light extinction	0.174	1/m-(mgD/L)	α_o
Macrophyte light extinction	0	$1/m\text{-}(gD/m^3)$	α_{mac}
Solar shortwave radiation model			
Atmospheric attenuation model for solar	Bras		
Bras solar parameter (used if Bras solar model is selected)			
atmospheric turbidity coefficient (2=clear, 5=smoggy, default=2)	4		n_{fac}
Ryan-Stolzenbach solar parameter (used if Ryan-Stolzenbach solar model is selected)			
atmospheric transmission coefficient (0.70-0.91, default 0.8)	0.8		a_{tc}
Downwelling atmospheric longwave IR radiation			
atmospheric longwave emissivity model	Koberg		
Evaporation and air convection/conduction			
wind speed function for evaporation and air convection/conduction	Adams 1		

QUAL2Kw

Stream Water Quality Model

Bayou Avoca (9/26/2006)

Diffuse Source Data:

			Diffuse	Diffuse		Spec	Inorg	Diss	CBOD	CBOD
			Abstraction	Inflow	Temp	Cond	SS	Oxygen	slow	fast
Name	Up (km)	Down (km)	m3/s	m3/s	C	umhos	mgD/L	mg/L	mgO2/L	mgO2/L
	22.90	0.00		0.0037	27.53	565.00	24.38	6.62	0.00	0.00

Organic	Ammon	Nitrate	Organic	Inorganic	Phyto			Generic		
N	N	N	P	P	plankton	Detritus	Pathogen	constituent	Alk	pH
ugN/L	ugN/L	ugN/L	ugP/L	ugP/L	ug/L	mgD/L	cfu/100 mL	user defined	mgCaCO3/L	
2600000.00	50.00	255.00	1150000.00	73.30	40.00	25000.00	0.00		120.00	8.12

QUAL2Kw

Stream Water Quality Model

Bayou Avoca (9/26/2006)

Global rate parameters

Parameter	*Value*	*Units*	*Symbol*
Stoichiometry:			
Carbon	40	gC	gC
Nitrogen	7.2	gN	gN
Phosphorus	1	gP	gP
Dry weight	100	gD	gD
Chlorophyll	0.5	gA	gA
Inorganic suspended solids:			
Settling velocity	0	m/d	v_i
Oxygen:			
Reaeration model	Internal		
Temp correction	1.024		θ_a
Reaeration wind effect	Wanninkhof		
O2 for carbon oxidation	2.69	gO_2/gC	r_{oc}
O2 for NH4 nitrification	4.57	gO_2/gN	r_{on}
Oxygen inhib model CBOD oxidation	Exponential		
Oxygen inhib parameter CBOD oxidation	0.60	L/mgO2	K_{socf}
Oxygen inhib model nitrification	Exponential		
Oxygen inhib parameter nitrification	0.60	L/mgO2	K_{sona}
Oxygen enhance model denitrification	Exponential		
Oxygen enhance parameter denitrification	0.60	L/mgO2	K_{sodn}
Oxygen inhib model phyto resp	Exponential		
Oxygen inhib parameter phyto resp	0.60	L/mgO2	K_{sop}
Oxygen enhance model bot alg resp	Exponential		
Oxygen enhance parameter bot alg resp	0.60	L/mgO2	K_{sob}
Slow CBOD:			
Hydrolysis rate	0.6	/d	k_{hc}
Temp correction	1.047		θ_{hc}
Oxidation rate	0	/d	k_{dcs}
Temp correction	1.047		θ_{dcs}
Fast CBOD:			
Oxidation rate	0.9	/d	k_{dc}
Temp correction	1.047		θ_{dc}
Organic N:			
Hydrolysis	0.01	/d	k_{hn}
Temp correction	1.07		θ_{hn}
Settling velocity	0	m/d	v_{on}
Ammonium:			
Nitrification	2	/d	k_{na}
Temp correction	1.07		θ_{na}
Nitrate:			
Denitrification	0.06	/d	k_{dn}
Temp correction	1.07		θ_{dn}
Sed denitrification transfer coeff	0.03	m/d	v_{di}
Temp correction	1.07		θ_{di}
Organic P:			
Hydrolysis	0.06	/d	k_{hp}
Temp correction	1.07		θ_{hp}
Settling velocity	0	m/d	v_{op}

QUAL2Kw

Stream Water Quality Model

Bayou Avoca (9/26/2006)

Global rate parameters

Inorganic P:			
Settling velocity	**0**	**m/d**	v_{ip}
Sed P oxygen attenuation half sat constant	**1.7**	**mgO_2/L**	k_{spi}
Phytoplankton:			
Max Growth rate	**5**	**/d**	k_{gp}
Temp correction	**1.07**		θ_{gp}
Respiration rate	**0.1**	**/d**	k_{rp}
Temp correction	**1.07**		θ_{rp}
Death rate	**0**	**/d**	k_{dp}
Temp correction	**1.07**		θ_{dp}
Nitrogen half sat constant	**60**	**ugN/L**	k_{sPp}
Phosphorus half sat constant	**25**	**ugP/L**	k_{sNp}
Inorganic carbon half sat constant	**1.30E-05**	**moles/L**	k_{sCp}
Phytoplankton use HCO3- as substrate	**Yes**		
Light model	**Steele**		
Light constant	**200**	**langleys/d**	K_{Lp}
Ammonia preference	**25**	**ugN/L**	k_{hnxp}
Settling velocity	**0.55**	**m/d**	v_a
Detritus (POM):			
Dissolution rate	**0.003**	**/d**	k_{dt}
Temp correction	**1.07**		θ_{dt}
Settling velocity	**0**	**m/d**	v_{dt}
pH:			
Partial pressure of carbon dioxide	**375**	**ppm**	p_{CO2}

APPENDIX F

Calibrated Models Output

Figure F.1. July Calibration for Lake Palourde

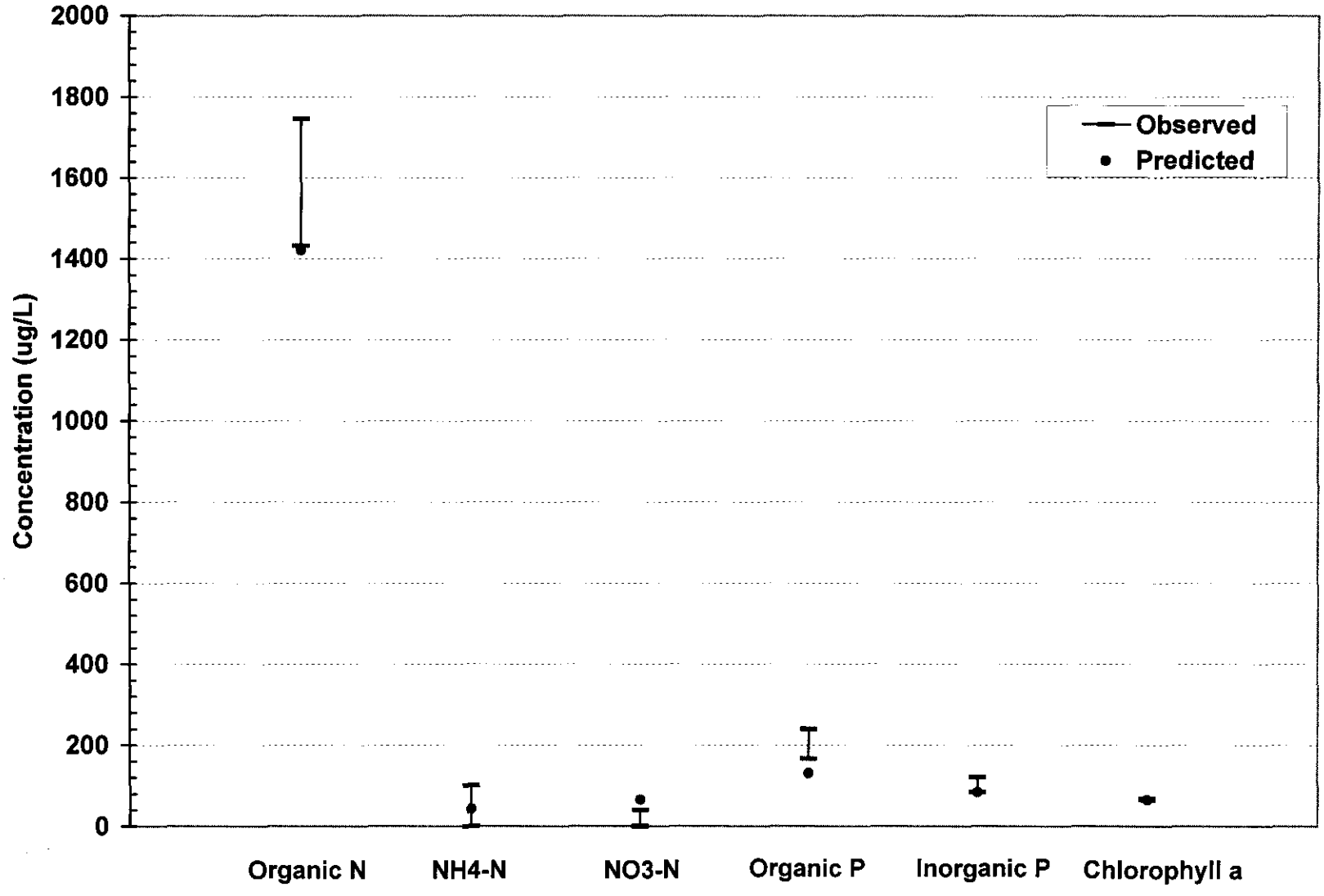
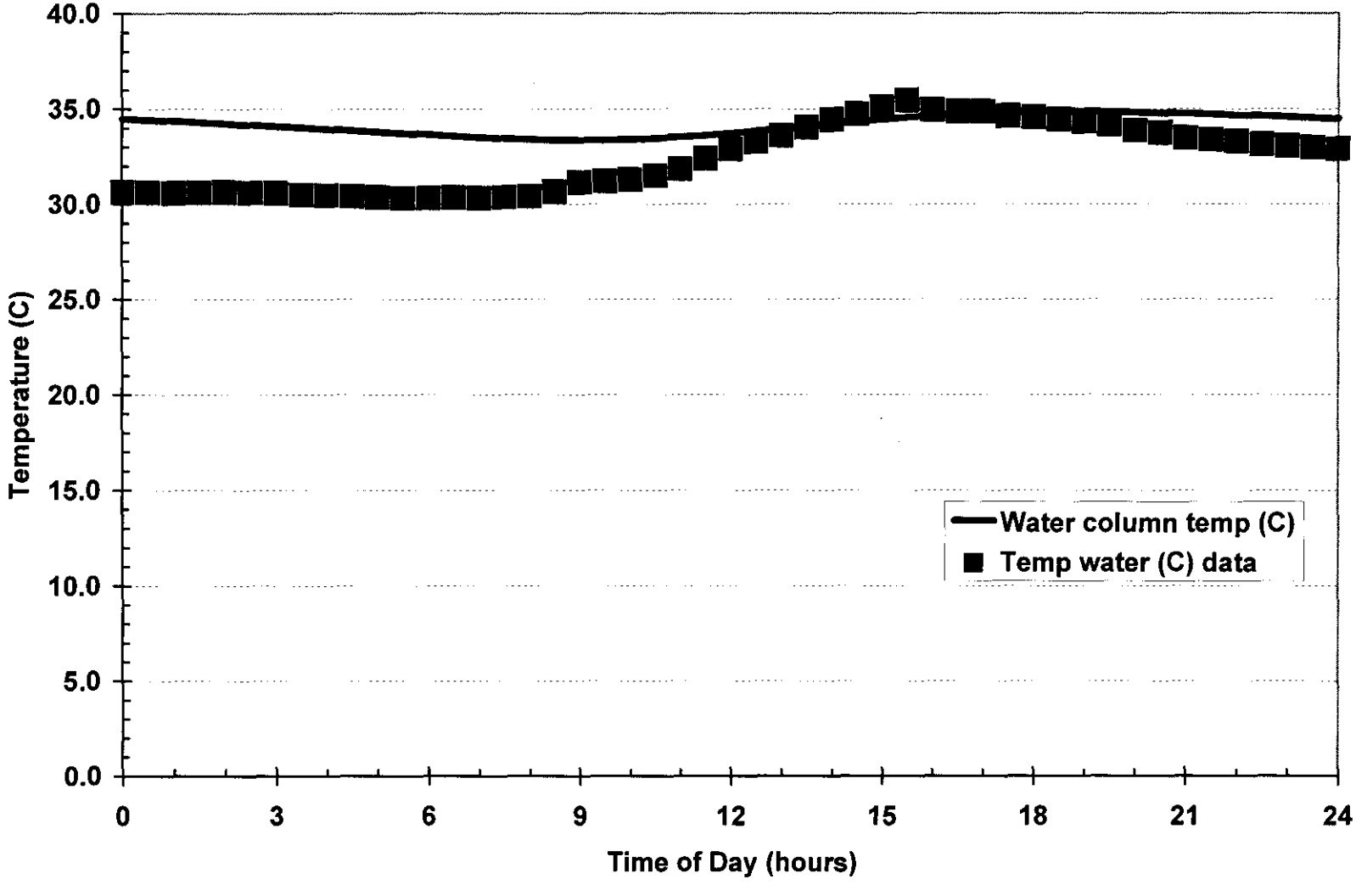
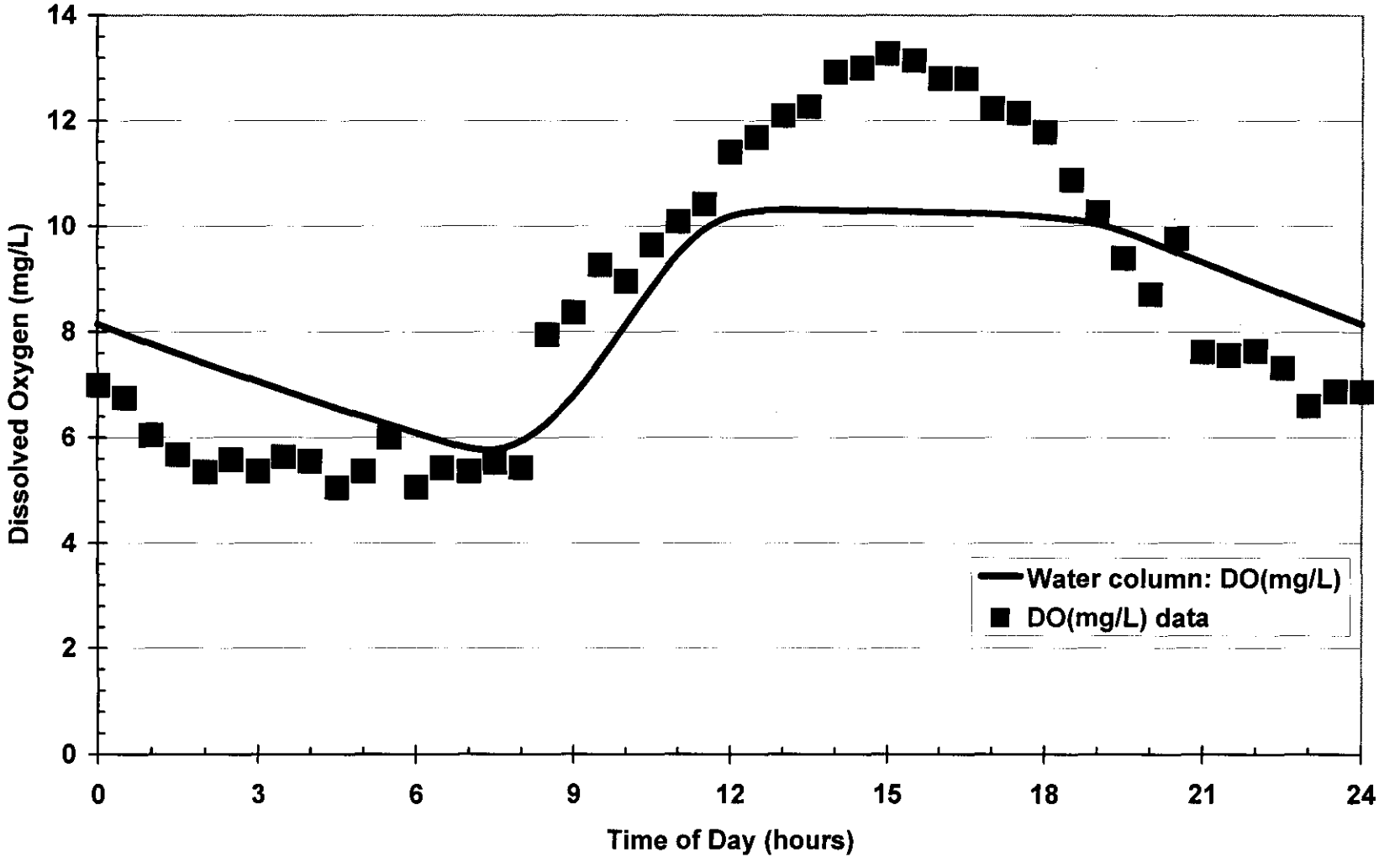


Figure F.2. July temperature calibration for Lake Palourde.



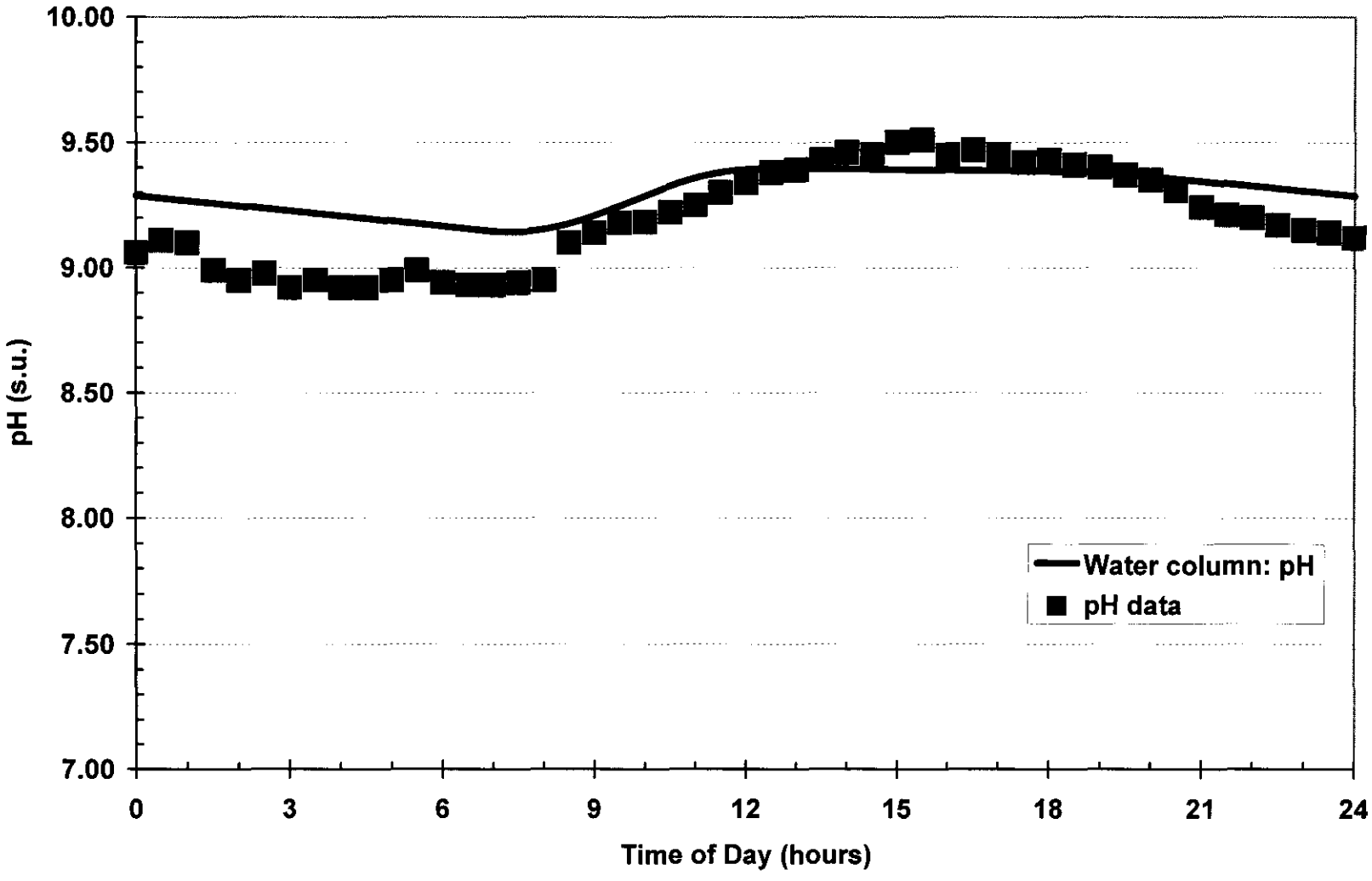
Palourde-July calib4.xls\Temp Diel, 5/2/2007

Figure F.3. July dissolved oxygen calibration for Lake Palourde.



Palourde-July calib4.xls\DO Diel, 5/2/2007

Figure F.4. July pH calibration for Lake Palourde.



Palourde-July calib4.xls\pH Diel, 5/2/2007

Figure F.5. September Calibration for Lake Palourde

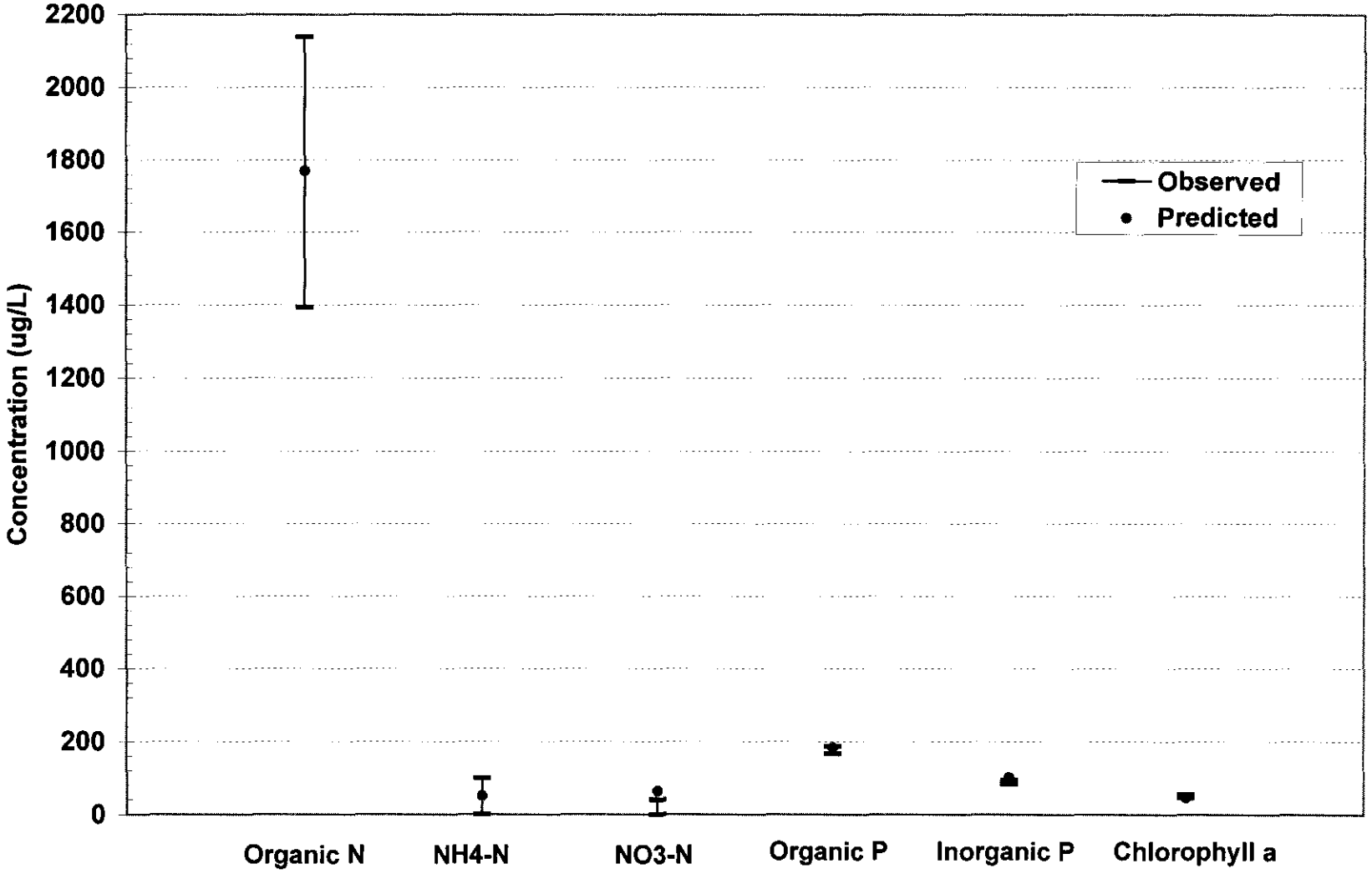
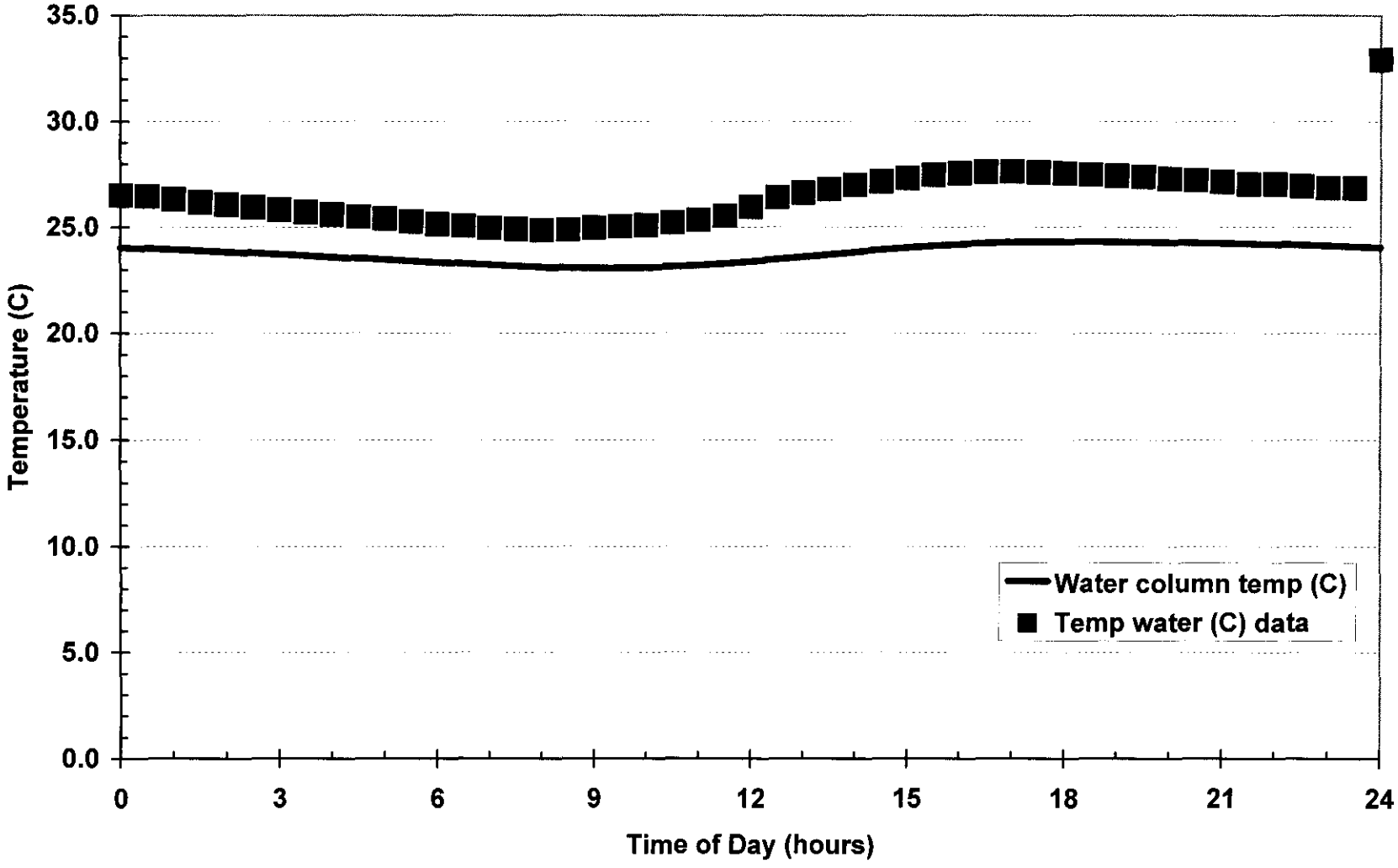
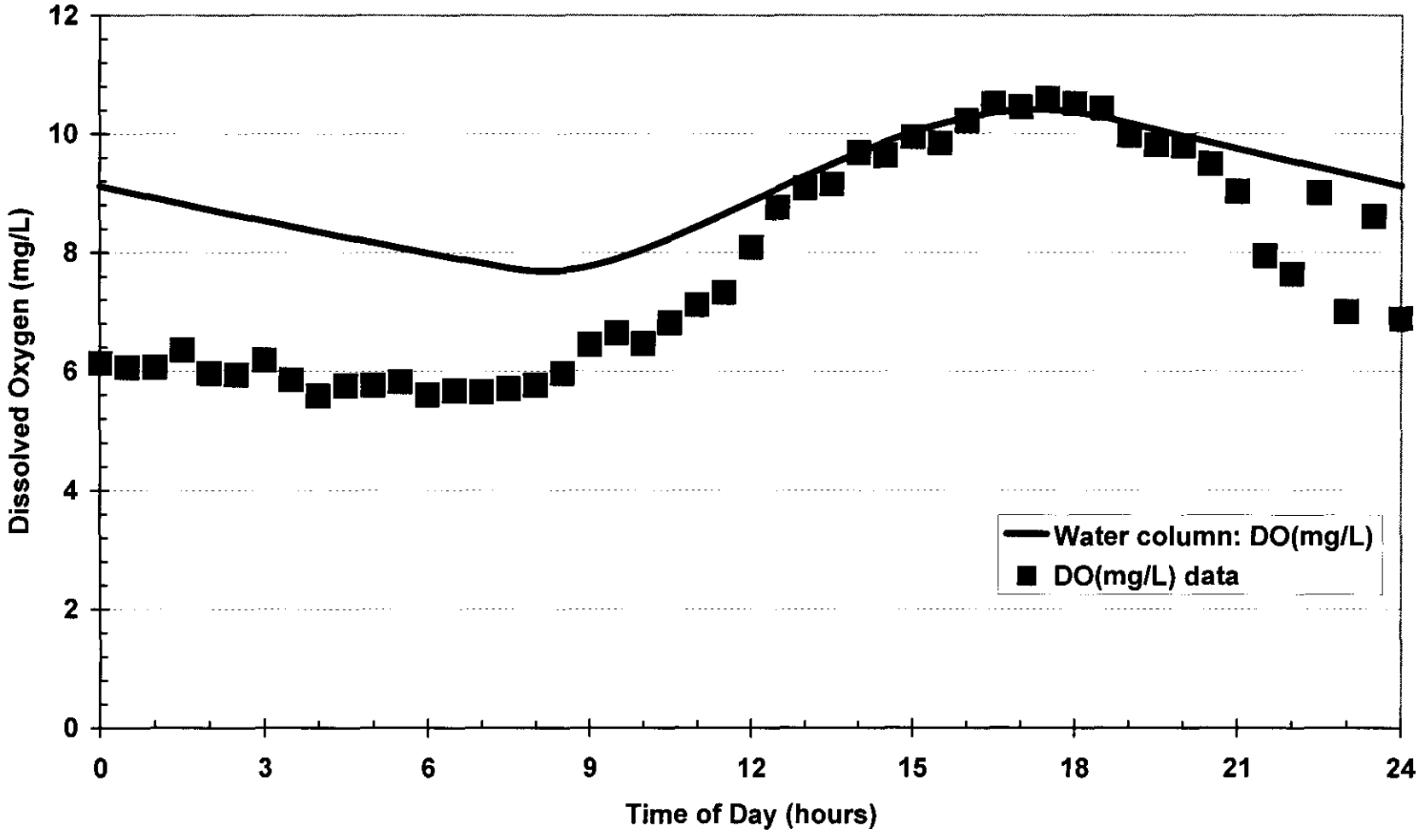


Figure F.6. September temperature calibration for Lake Palourde.



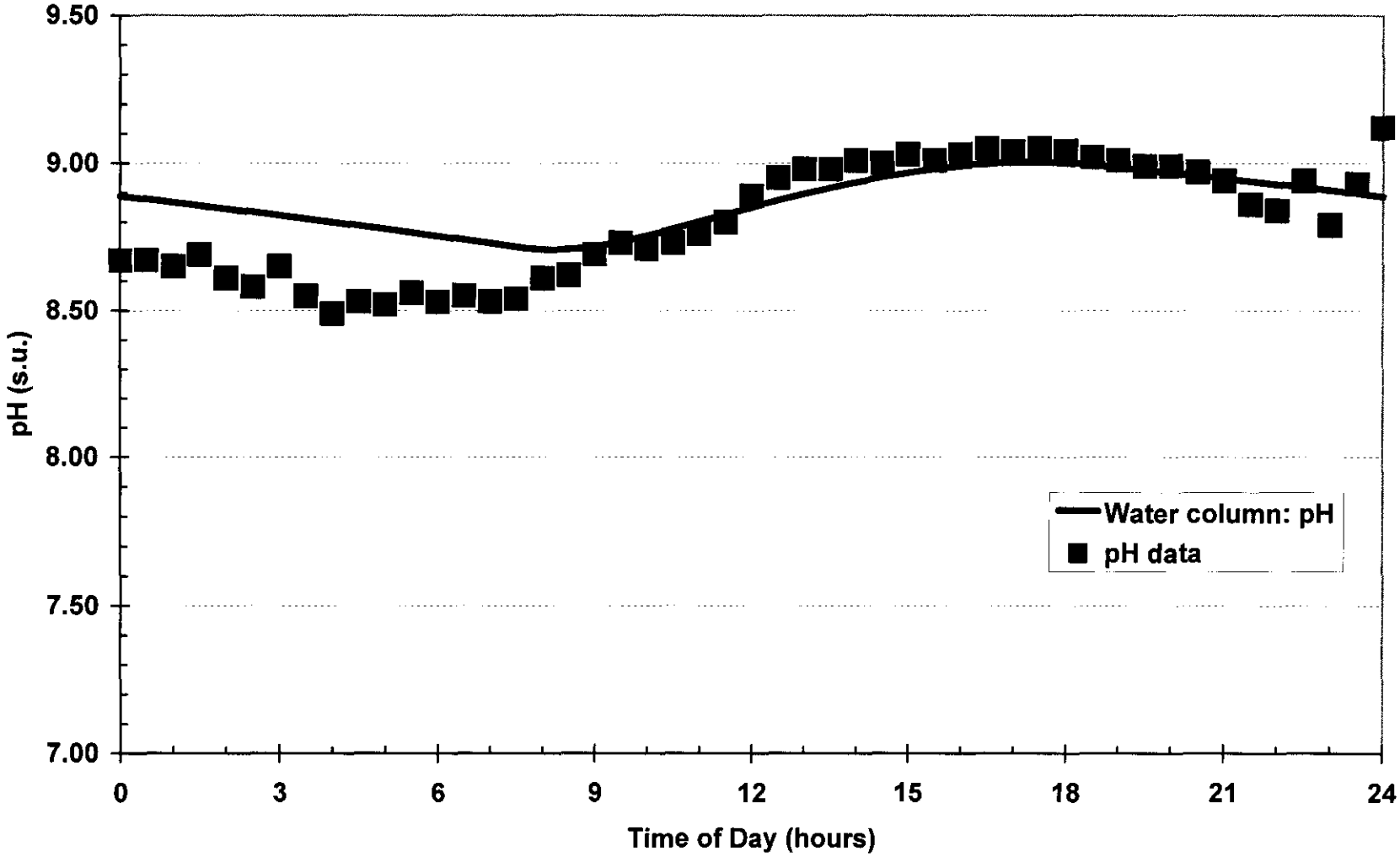
Palourde-Sept calib4.xls\Temp Diel, 5/2/2007

Figure F.7. September dissolved oxygen calibration for Lake Palourde.



Palourde-Sept calib4.xls\DO Diel, 5/2/2007

Figure F.8. September pH calibration for Lake Palourde.



Palourde-Sept calib4.xls\pH Diel, 5/2/2007

Figure F.9. July Calibration for Bayou Avoca

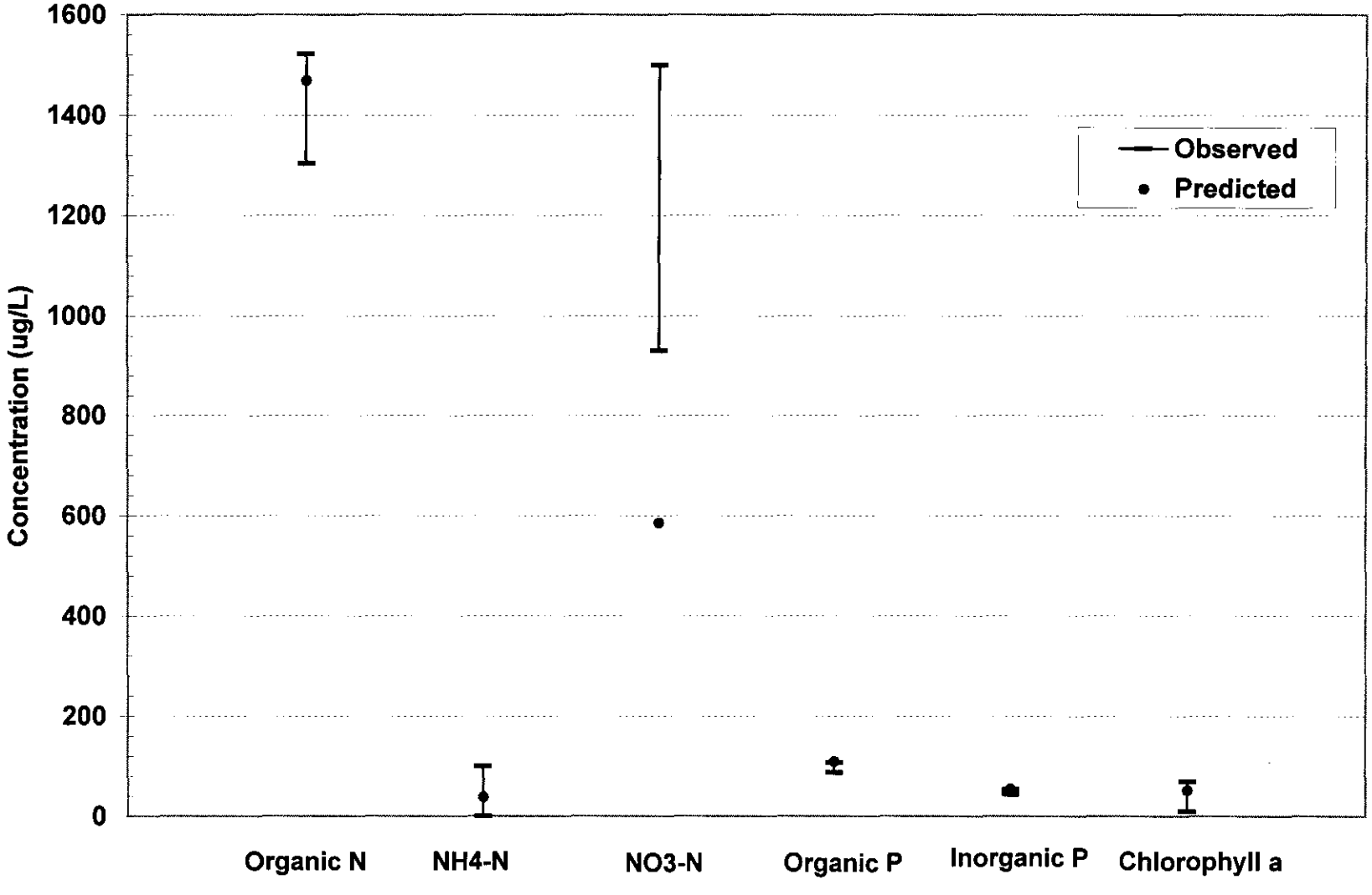
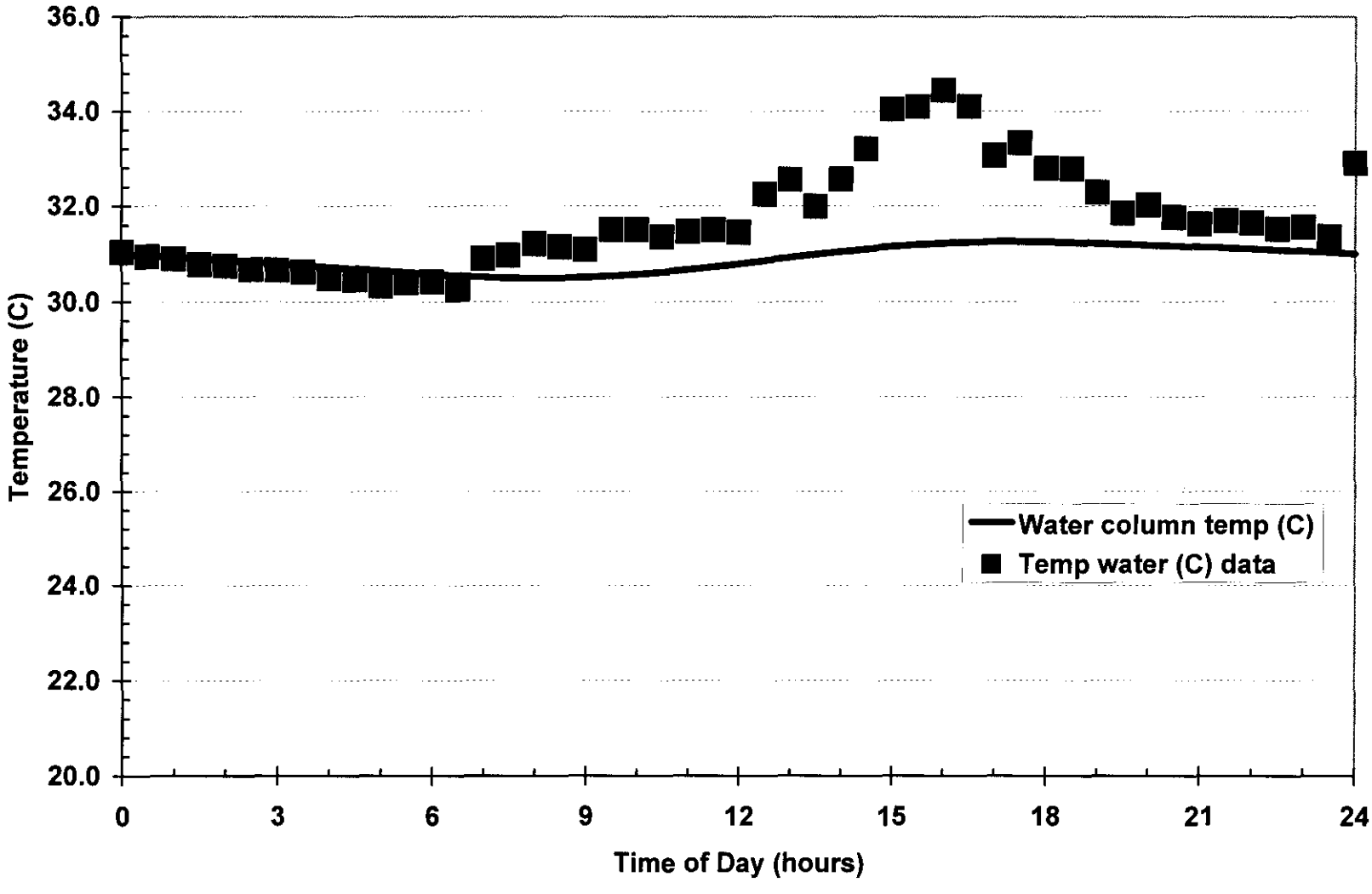
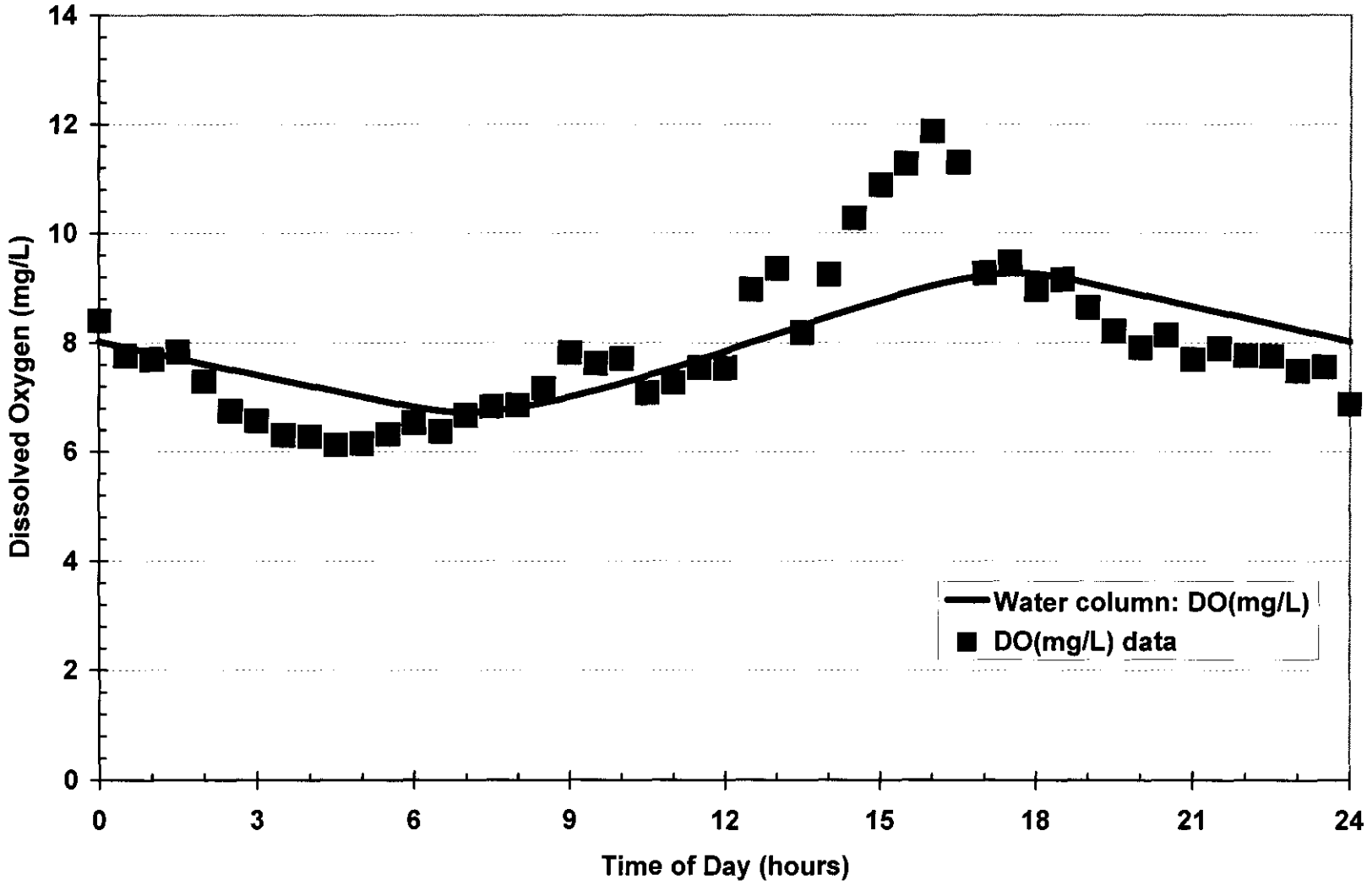


Figure F.10. July temperature calibration for Bayou Avoca.



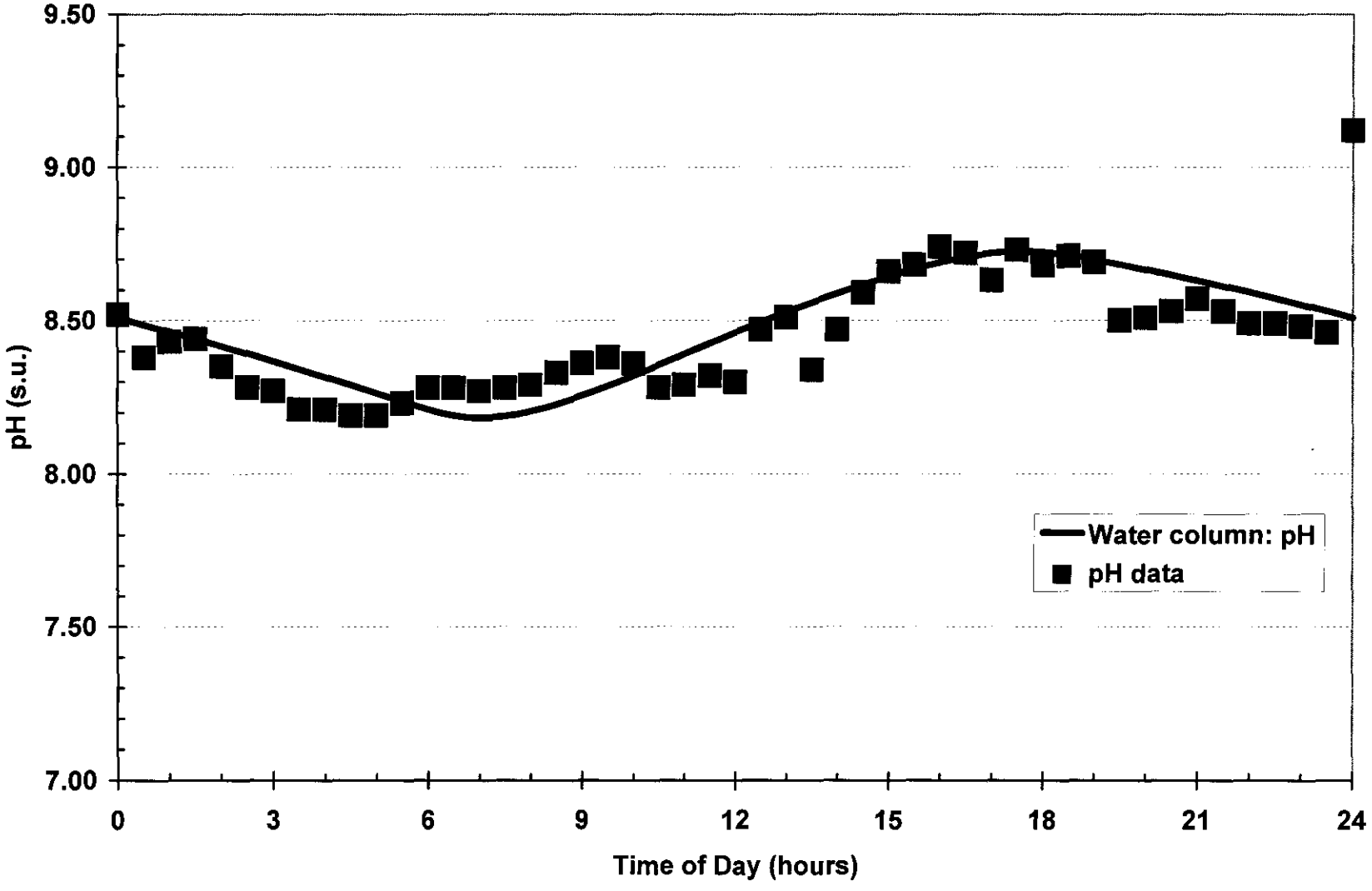
Avoca-July calibration.xls\Temp Diel, 5/2/2007

Figure F.11. July dissolved oxygen calibration for Bayou Avoca.



Avoca-July calibration.xls\DO Diel, 5/2/2007

Figure F.12. July pH calibration for Bayou Avoca.



Avoca-July calibration.xls\pH Diel, 5/2/2007

Figure F.13. September Calibration for Bayou Avoca

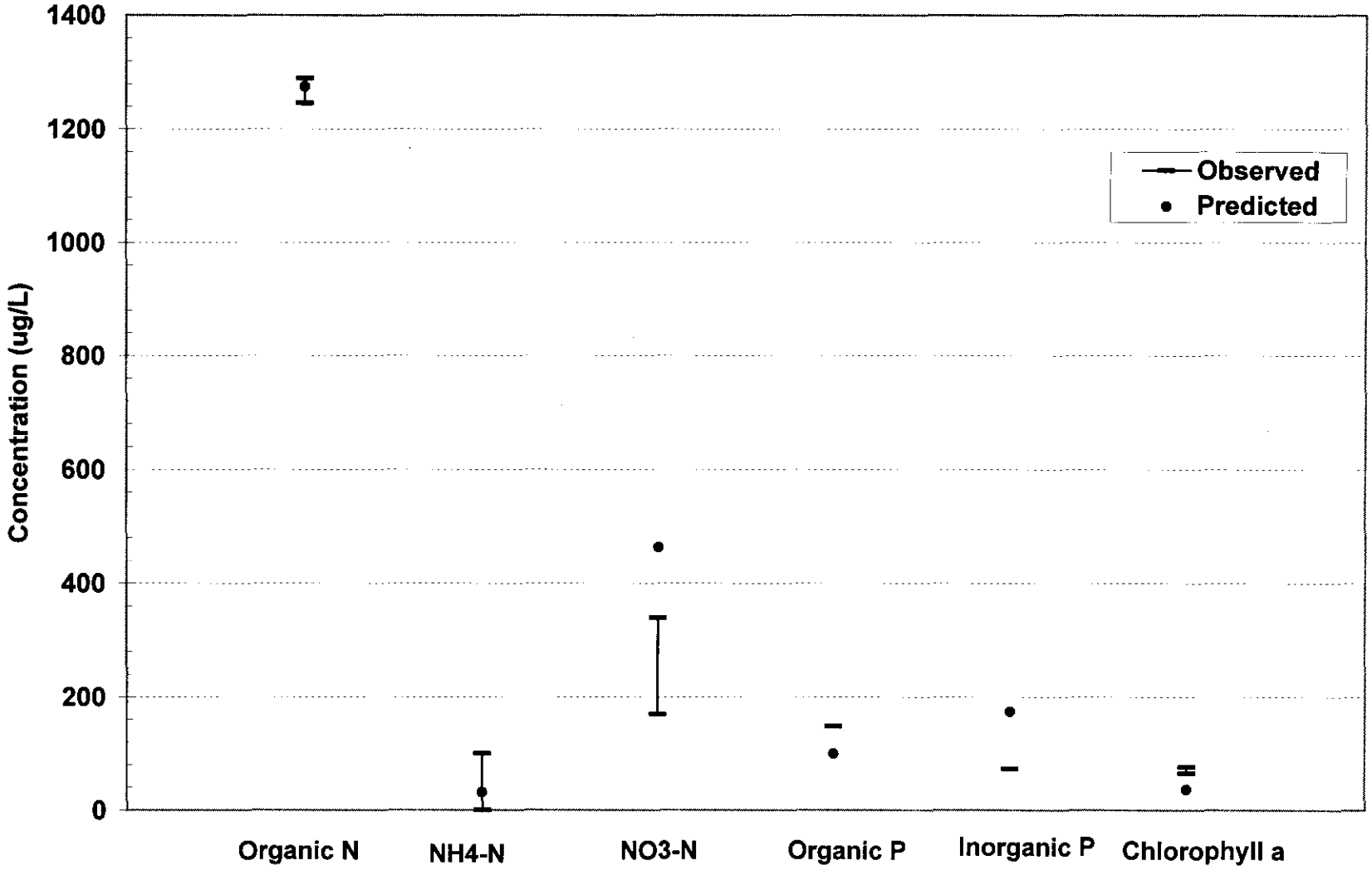
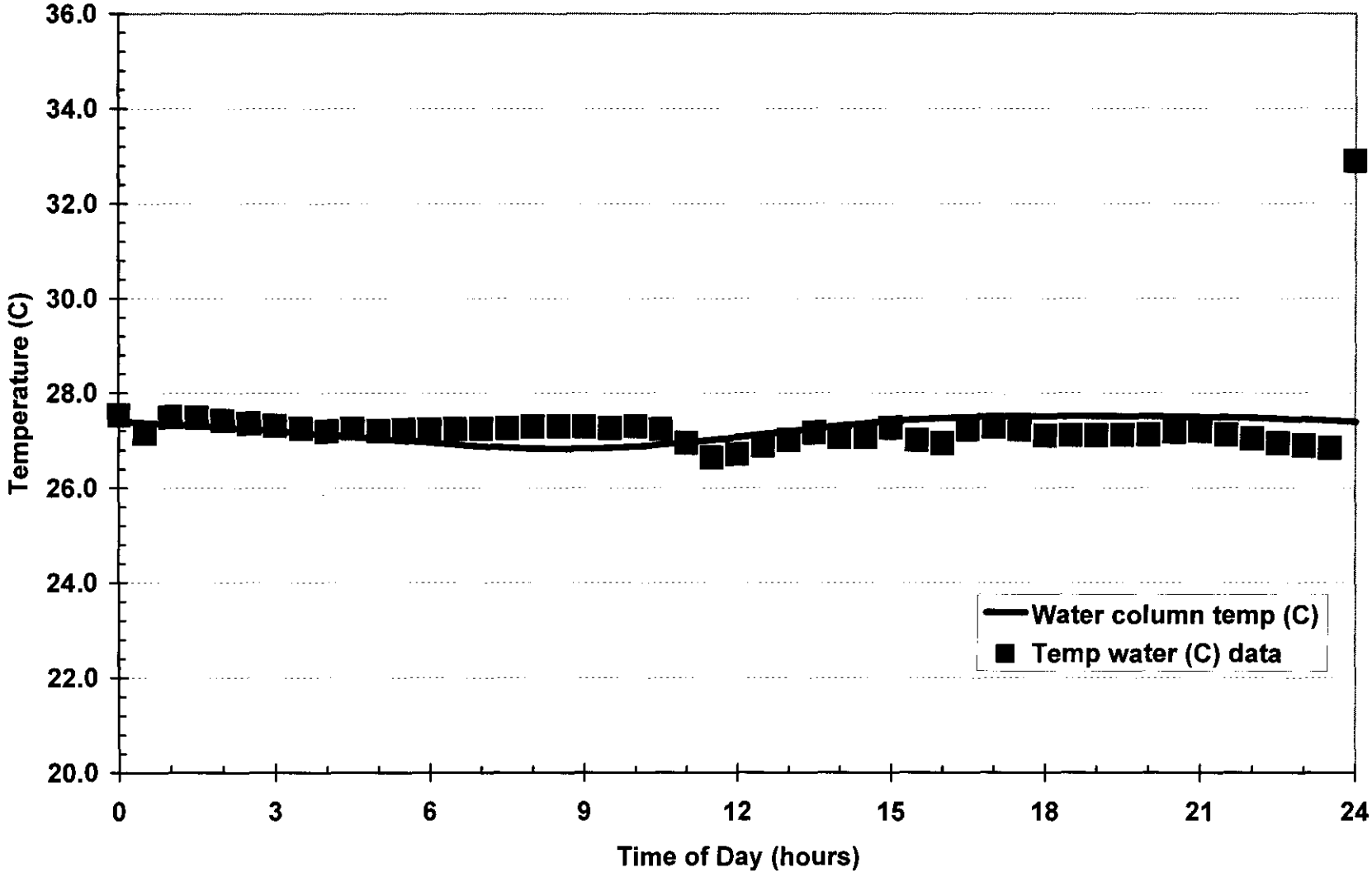
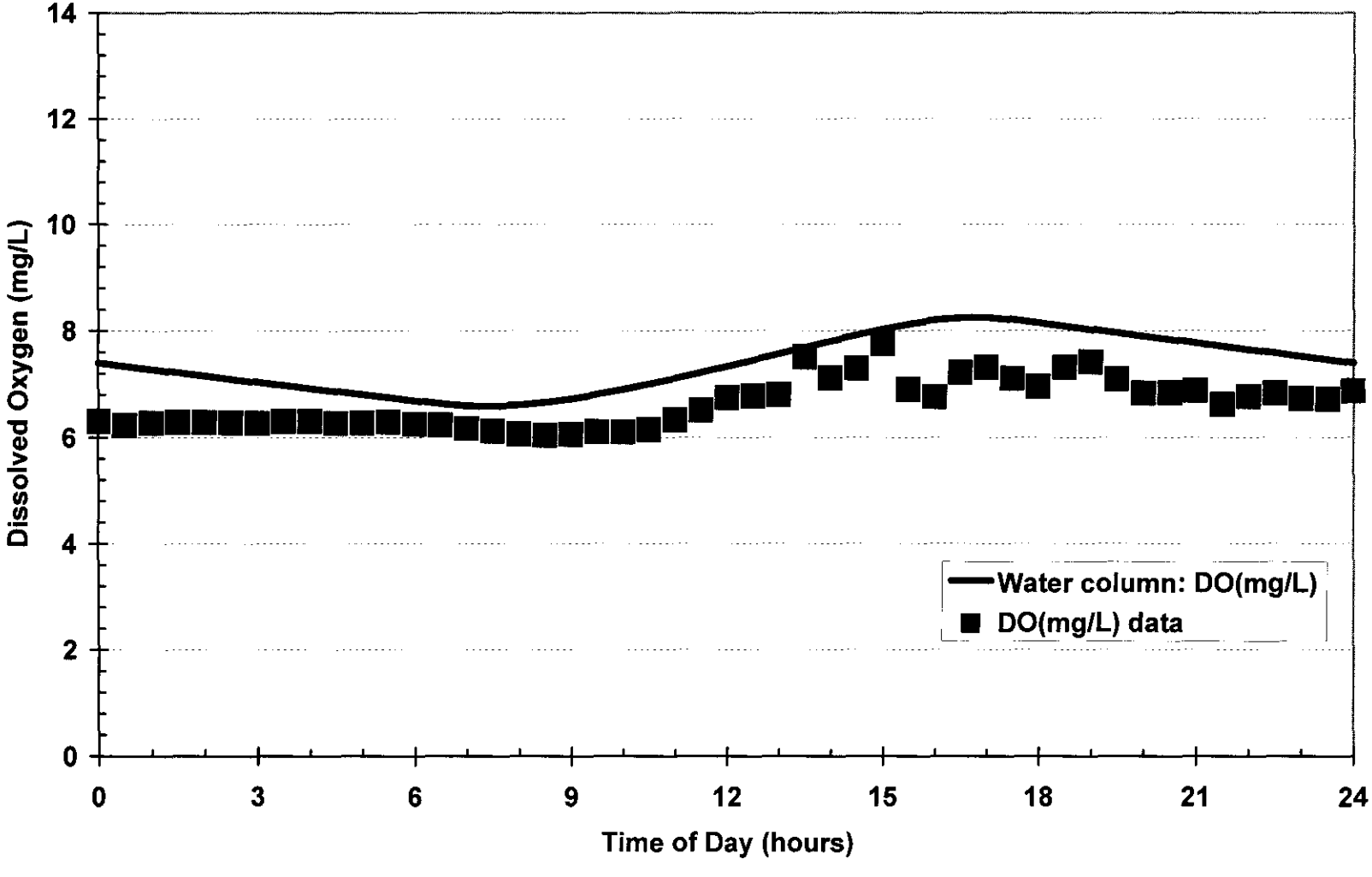


Figure F.14. September temperature calibration for Bayou Avoca.



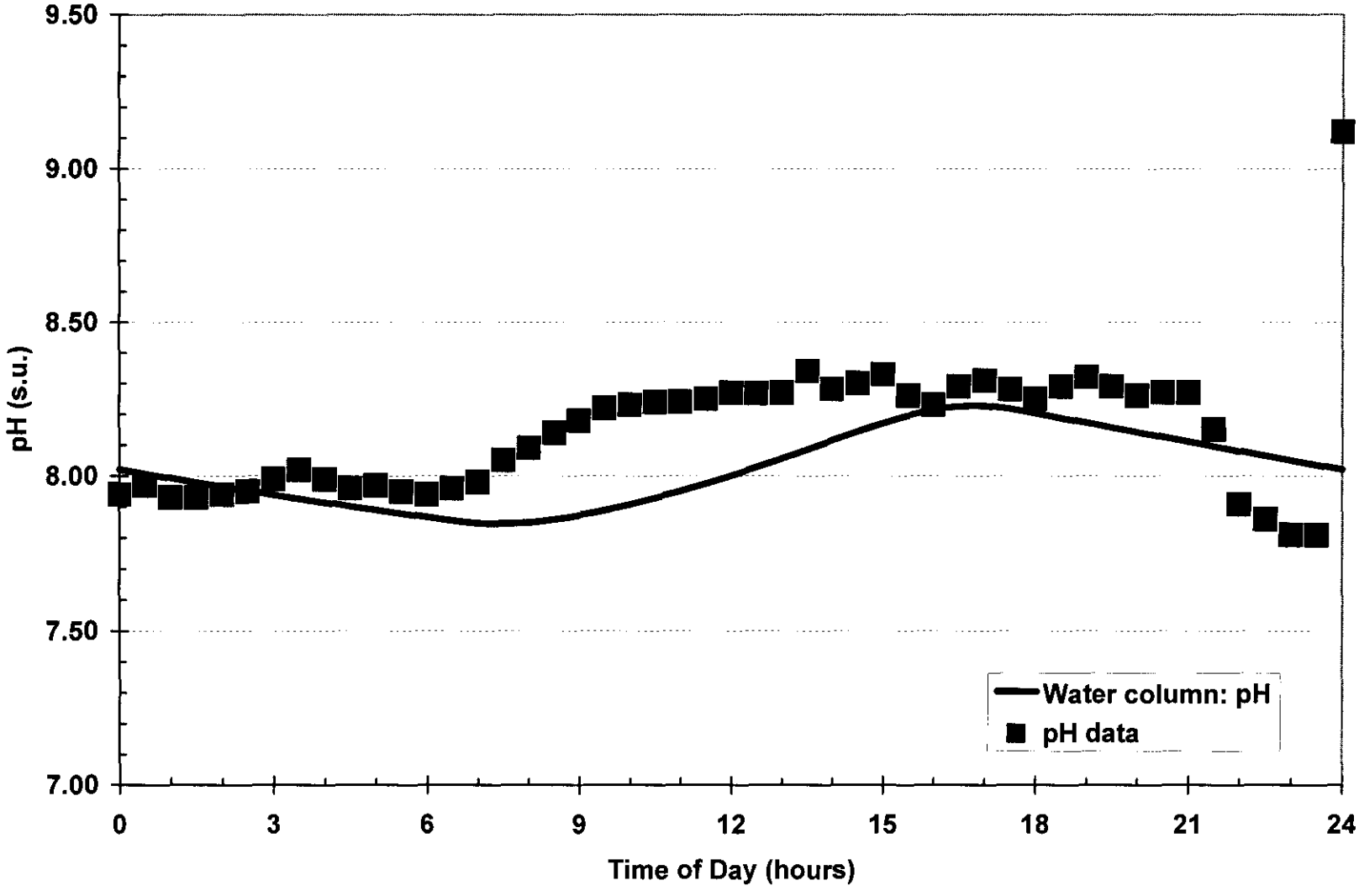
Avoca-Sept newQ.xls\Temp Diel, 5/2/2007

Figure F.15. September dissolved oxygen calibration for Bayou Avoca.



Avoca-Sept newQ.xls\DO Diel, 5/2/2007

Figure F.16. September pH calibration for Bayou Avoca.



Avoca-Sept newQ.xls\pH Diel, 5/2/2007

APPENDIX G

Inputs for Projection Models to achieve pH Water Quality Criteria

QUAL2Kw (version 5.1)

Stream Water Quality Model

Greg Pelletier, Steve Chapra, and Hua Tao

Department of Ecology and Tufts University

System ID:		
River name	Lake Palourde	
Saved file name	Palourde-July-proj-pH85	
Directory where the input/output files are saved	ch\qual2k\qual2kw\qual2kw\v51b37\palourde	
Month	7	
Day	16	
Year	2006	
Time zone	Central	
Daylight savings time	Yes	
Simulation and output options:		
Calculation step	11.25	minutes
Number of days	2000	days
Solution method (integration)	Euler	
Solution method (pH)	Newton-Raphson	
Simulate hyporheic exchange and pore water quality	No	
Display dynamic diel output	Yes	
State variables for simulation	All	
Simulate sediment diagenesis	Yes	
Program determined calc step	11.25	minutes
Time elapsed during last model run	0.46	minutes
Time of sunrise	6:14 AM	
Time of solar noon	1:10 PM	
Time of sunset	8:06 PM	
Photoperiod	13.86	hours

QUAL2Kw

Stream Water Quality Model

Lake Palourde (7/16/2006)

Headwater and Downstream Boundary Data:

Headwater Flow	83.818	m3/s								
Prescribed downstream boundary?	No									
Headwater Water Quality	*Units*	*12:00 AM*	*1:00 AM*	*2:00 AM*	*3:00 AM*	*4:00 AM*	*5:00 AM*	*6:00 AM*	*7:00 AM*	*8:00 AM*
Temperature	C	30.62	30.59	30.64	30.58	30.45	30.36	30.32	30.31	30.42
Conductivity	umhos	384.00	384.00	384.00	384.00	384.00	384.00	384.00	384.00	384.00
Inorganic Solids	mgD/L	14.17	14.17	14.17	14.17	14.17	14.17	14.17	14.17	14.17
Dissolved Oxygen	mg/L	8.61	8.61	8.61	8.61	8.61	8.61	8.61	8.61	8.61
CBODslow	mgO2/L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CBODfast	mgO2/L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Organic Nitrogen	ugN/L	635.60	635.60	635.60	635.60	635.60	635.60	635.60	635.60	635.60
NH4-Nitrogen	ugN/L	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
NO3-Nitrogen	ugN/L	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
Organic Phosphorus	ugP/L	81.32	81.32	81.32	81.32	81.32	81.32	81.32	81.32	81.32
Inorganic Phosphorus (SRP)	ugP/L	40.68	40.68	40.68	40.68	40.68	40.68	40.68	40.68	40.68
Phytoplankton	ugA/L	66.50	66.50	66.50	66.50	66.50	66.50	66.50	66.50	66.50
Detritus (POM)	mgD/L	10.83	10.83	10.83	10.83	10.83	10.83	10.83	10.83	10.83
Pathogen	cfu/100 mL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Generic constituent	user defined	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Alkalinity	mgCaCO3/L	105.00	105.00	105.00	105.00	105.00	105.00	105.00	105.00	105.00
pH	s.u.	9.20	9.20	9.20	9.20	9.20	9.20	9.20	9.20	9.20
Downstream Boundary Water Quality (optional)	*Units*	*12:00 AM*	*1:00 AM*	*2:00 AM*	*3:00 AM*	*4:00 AM*	*5:00 AM*	*6:00 AM*	*7:00 AM*	*8:00 AM*
Temperature	C									
Conductivity	umhos									
Inorganic Solids	mgD/L									
Dissolved Oxygen	mg/L									
CBODslow	mgO2/L									
CBODfast	mgO2/L									
Organic Nitrogen	ugN/L									
NH4-Nitrogen	ugN/L									
NO3-Nitrogen	ugN/L									
Organic Phosphorus	ugP/L									
Inorganic Phosphorus (SRP)	ugP/L									
Phytoplankton	ugA/L									
Detritus (POM)	mgD/L									
Pathogen	cfu/100 mL									
Generic constituent	user defined									
Alkalinity	mgCaCO3/L									
pH	s.u.									

QUAL2Kw

Stream Water Quality Model

Lake Palourde (7/16/2006)

Reach Data:

Reach for diel plot:	2							
			Reach			*Downstream*	*Elevation*	
Reach	*Downstream*		*length*	*Downstream*		*location*	*Upstream*	*Downstream*
Label	*end of reach label*	*Number*	*(km)*	*Latitude*	*Longitude*	*(km)*	*(m)*	*(m)*
	Headwater	0		29.75	91.12	7.500		1.000
Lake Palourde 1		1	0.10	29.73	91.13	7.400	1.000	1.000
Lake Palourde 2		2	7.40	29.71	91.12	0.000	1.000	1.000

						Hydraulic Model (Weir Overrides Rating Curves; F					
Downstream						*Weir*		Rating Curves			
Latitude			*Longitude*			*Height*	*Width*	*Velocity*		Depth	
Degrees	*Minutes*	*Seconds*	*Degrees*	*Minutes*	*Seconds*	*(m)*	*(m)*	*Coefficient*	*Exponent*	*Coefficient*	*Exponent*
29	45	10	91	7	7	0.0000	0.000	0.0001	1.000	2.0000	0.000
29	44	3	91	7	40	0.0000	0.000	0.0001	1.000	2.0000	0.000
29.00	42	42	91.00	7	19	0.0000	0.000	0.0001	1.000	2.0000	0.000

Rating Curves Override Manning Formula)										
Manning Formula					Prescribed	Bottom	Bottom	Prescribed	Prescribed	Prescribed
Channel	Manning	Bot Width	Side	Side	Dispersion	Algae	SOD	SOD	CH4 flux	NH4 flux
Slope	n	m	Slope	Slope	m2/s	Coverage	Coverage	gO2/m2/d	gO2/m2/d	mgN/m2/d
0.00	0	0.0000	0.00	0.0000	0.000					
0.00	0	0.0000	0.00	0.0000	0.000	0%	100%	0.00	0.0000	0.0000
0.00	0	0.0000	0.00	0.0000	0.000	0%	100%	0.00	0.0000	0.0000

Prescribed	Sediment	Sediment	Sediment/hyporheic	Hyporheic	Hyporheic
Inorg P flux	thermal cond	thermal diff	zone thickness	exchange flow	sediment porosity
mgP/m2/d	(W/m/degC)	(cm^2/sec)	(cm)	(fraction of stream flow)	(fraction of volume)
0.0000	1.6	0.0064	10	0%	40%
0.0000	1.6	0.0064	10	0%	40%

QUAL2Kw

Stream Water Quality Model

Lake Palourde (7/16/2006)

Air Temperature Data:

				Upstream	Downstream	12:00 AM	1:00 AM	2:00 AM
Upstream	Reach	Downstream	Reach	Distance	Distance	Hourly air temperature for each reach		
Label	Label	Label	Number	km	km	(The input values are applied as poin		
Headwater	Lake Palourde 1		1	7.50	7.40	28.85	27.70	26.82
	Lake Palourde 2		2	7.40	0.00	28.85	27.70	26.82

3:00 AM	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM
(degrees C)										
t estimates at each time. Linear interpolation is used to estimate values between the hourly inputs.)										
26.23	25.92	25.82	25.91	26.23	26.80	27.68	28.83	30.15	31.47	32.63
26.23	25.92	25.82	25.91	26.23	26.80	27.68	28.83	30.15	31.47	32.63

2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM	10:00 PM	11:00 PM
33.51	34.10	34.41	34.51	34.42	34.11	33.54	32.66	31.51	30.19
33.51	34.10	34.41	34.51	34.42	34.11	33.54	32.66	31.51	30.19

QUAL2Kw

Stream Water Quality Model

Lake Palourde (7/16/2006)

Dew Point Temperature Data:

				Upstream	Downstream	12:00 AM	1:00 AM	2:00 AM
Upstream	Reach	Downstream	Reach	Distance	Distance	Hourly dewpoint temperature for eac		
Label	Label	Label	Number	km	km	(The input values are applied as poin		
Headwater	Lake Palourde 1		1	7.50	7.40	25.39	24.38	23.60
	Lake Palourde 2		2	7.40	0.00	25.39	24.38	23.60

3:00 AM	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM
h reach (degrees C)										
t estimates at each time. Linear interpolation is used to estimate values between the hourly inputs.)										
23.08	22.81	22.72	22.80	23.08	23.58	24.36	25.37	26.53	27.69	28.71
23.08	22.81	22.72	22.80	23.08	23.58	24.36	25.37	26.53	27.69	28.71

2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM	10:00 PM	11:00 PM
29.49	30.01	30.28	30.37	30.29	30.02	29.52	28.74	27.73	26.57
29.49	30.01	30.28	30.37	30.29	30.02	29.52	28.74	27.73	26.57

QUAL2Kw

Stream Water Quality Model

Lake Palourde (7/16/2006)

Wind Speed Data:

				Upstream	Downstream	12:00 AM	1:00 AM	2:00 AM
Upstream	Reach	Downstream	Reach	Distance	Distance	Wind speed for each reach 7m above		
Label	Label	Label	Number	km	km	(The input values are applied as poin		
Headwater	Lake Palourde 1		1	7.50	7.40	1.43	1.43	1.43
	Lake Palourde 2		2	7.40	0.00	1.43	1.43	1.43

3:00 AM	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM
water surface (m/s)										
t estimates at each time. Linear interpolation is used to estimate values between the hourly inputs.)										
1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43
1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43

2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM	10:00 PM	11:00 PM
1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43
1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43

QUAL2Kw

Stream Water Quality Model

Lake Palourde (7/16/2006)

Cloud Cover Data:

				Upstream	Downstream	12:00 AM	1:00 AM	2:00 AM
Upstream	Reach	Downstream	Reach	Distance	Distance	Hourly cloud cover shade for each re		
Label	Label	Label	Number	km	km	(Percent of sky that is covered by clo		
Headwater	Lake Palourde 1		1	7.50	7.40	15.0%	15.0%	15.0%
	Lake Palourde 2		2	7.40	0.00	15.0%	15.0%	15.0%

3:00 AM	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM
ach (Percent)										
uds. The input values are applied as point estimates at each time. Linear interpolation is used to estimate values between the hourly inpu										
15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%
15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%

2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM	10:00 PM	11:00 PM
ts.)									
15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%
15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%

QUAL2Kw

Stream Water Quality Model

Lake Palourde (7/16/2006)

Light Parameters and Surface Heat Transfer Models:

Parameter	*Value*	*Unit*	
Photosynthetically Available Radiation	0.47		
Background light extinction	0.2	/m	k_{eb}
Linear chlorophyll light extinction	0.0088	1/m-(ugA/L)	α_p
Nonlinear chlorophyll light extinction	0.054	$1/m\text{-}(ugA/L)^{2/3}$	α_{pn}
ISS light extinction	0.052	1/m-(mgD/L)	α_i
Detritus light extinction	0.174	1/m-(mgD/L)	α_o
Macrophyte light extinction	0	$1/m\text{-}(gD/m^3)$	α_{mac}
Solar shortwave radiation model			
Atmospheric attenuation model for solar	Bras		
Bras solar parameter (used if Bras solar model is selected)			
atmospheric turbidity coefficient (2=clear, 5=smoggy, default=2)	4		n_{fac}
Ryan-Stolzenbach solar parameter (used if Ryan-Stolzenbach solar model is selected)			
atmospheric transmission coefficient (0.70-0.91, default 0.8)	0.8		a_{tc}
Downwelling atmospheric longwave IR radiation			
atmospheric longwave emissivity model	Koberg		
Evaporation and air convection/conduction			
wind speed function for evaporation and air convection/conduction	Adams 1		

QUAL2Kw

Stream Water Quality Model

Lake Palourde (7/16/2006)

Point Source Data:

		Point	Point	Temperature		
		Abstraction	Inflow	mean	range/2	time of
Name	Location (km)	m3/s	m3/s	°C	°C	max
Morgan City MS4	3.80	0.0000	0.3720	32.40	0.00	12:00 AM

Specific Conductance			Inorganic Suspended Solids			Dissolved Oxygen		
mean	range/2	time of	mean	range/2	time of	mean	range/2	time of
umhos	umhos	max	mg/L	mg/L	max	mg/L	mg/L	max
384.00	0.00	12:00 AM	14.17	0.00	12:00 AM	8.61	0.00	12:00 AM

Slow CBOD			Fast CBOD			Organic N		
mean	range/2	time of	mean	range/2	time of	mean	range/2	time of
mgO2/L	mgO2/L	max	mgO2/L	mgO2/L	max	ugN/L	ugN/L	max
0.00	0.00	12:00 AM	0.00	0.00	12:00 AM	1916.00	0.00	12:00 AM

Ammonia N			Nitrate + Nitrite N			Organic P		
mean	range/2	time of	mean	range/2	time of	mean	range/2	time of
ugN/L	ugN/L	max	ugN/L	ugN/L	max	ugP/L	ugP/L	max
60.00	0.00	12:00 AM	24.00	0.00	12:00 AM	200.00	0.00	12:00 AM

Inorganic P			Phytoplankton			Detritus		
mean	range/2	time of	mean	range/2	time of	mean	range/2	time of
ugP/L	ugP/L	max	ugA/L	ugA/L	max	mgD/L	mgD/L	max
100.00	0.00	12:00 AM	66.5	0.00	12:00 AM	10.8	0.00	12:00 AM

Pathogen Indicator Bacteria			Generic constituent			Alkalinity		
mean	range/2	time of	mean	range/2	time of	mean	range/2	time of
cfu/100ml	cfu/100ml	max	user defined	user defined	max	mgCaCO3/L	mgCaCO3/L	max
0.0	0.00	12:00 AM	0.0	0.00	12:00 AM	105.0	0.00	12:00 AM

pH		
mean	range/2	time of
s.u.	s.u.	max
9.2	0.00	12:00 AM

QUAL2Kw

Stream Water Quality Model

Lake Palourde (7/16/2006)

Diffuse Source Data:

			Diffuse	Diffuse		Spec	Inorg	Diss	CBOD
			Abstraction	Inflow	Temp	Cond	SS	Oxygen	slow
Name	Up (km)	Down (km)	m3/s	m3/s	C	umhos	mgD/L	mg/L	mgO2/L
Nonpoint Sources	7.50	0.00	0.0000	0.0043	32.40	384.00	14.17	8.61	0.00

CBOD	Organic	Ammon	Nitrate	Organic	Inorganic	Phyto			Generic		
fast	N	N	N	P	P	plankton	Detritus	Pathogen	constituent	Alk	pH
mgO2/L	ugN/L	ugN/L	ugN/L	ugP/L	ugP/L	ug/L	mgD/L	cfu/100 mL	user defined	mgCaCO3/L	
0.00	0.0	0.0	0.0	0.0	0.0	66.5	10.8	0.0	0.0	105.0	9.2

QUAL2Kw

Stream Water Quality Model

Lake Palourde (7/16/2006)

Global rate parameters

Parameter	*Value*	*Units*	*Symbol*
Stoichiometry:			
Carbon	40	gC	gC
Nitrogen	7.2	gN	gN
Phosphorus	1	gP	gP
Dry weight	100	gD	gD
Chlorophyll	0.5	gA	gA
Inorganic suspended solids:			
Settling velocity	0	m/d	v_i
Oxygen:			
Reaeration model	Internal		
Temp correction	1.024		θ_a
Reaeration wind effect	Wanninkhof		
O2 for carbon oxidation	2.69	gO_2/gC	r_{oc}
O2 for NH4 nitrification	4.57	gO_2/gN	r_{on}
Oxygen inhib model CBOD oxidation	Exponential		
Oxygen inhib parameter CBOD oxidation	0.60	L/mgO2	K_{socf}
Oxygen inhib model nitrification	Exponential		
Oxygen inhib parameter nitrification	0.60	L/mgO2	K_{sona}
Oxygen enhance model denitrification	Exponential		
Oxygen enhance parameter denitrification	0.60	L/mgO2	K_{sodn}
Oxygen inhib model phyto resp	Exponential		
Oxygen inhib parameter phyto resp	0.60	L/mgO2	K_{sop}
Oxygen enhance model bot alg resp	Exponential		
Oxygen enhance parameter bot alg resp	0.60	L/mgO2	K_{sob}
Slow CBOD:			
Hydrolysis rate	0.6	/d	k_{hc}
Temp correction	1.047		θ_{hc}
Oxidation rate	0	/d	k_{dcs}
Temp correction	1.047		θ_{dcs}
Fast CBOD:			
Oxidation rate	0.9	/d	k_{dc}
Temp correction	1.047		θ_{dc}
Organic N:			
Hydrolysis	0.01	/d	k_{hn}
Temp correction	1.07		θ_{hn}
Settling velocity	0	m/d	v_{on}
Ammonium:			
Nitrification	2	/d	k_{na}
Temp correction	1.07		θ_{na}
Nitrate:			
Denitrification	0.06	/d	k_{dn}
Temp correction	1.07		θ_{dn}
Sed denitrification transfer coeff	0.03	m/d	v_{di}
Temp correction	1.07		θ_{di}

QUAL2Kw

Stream Water Quality Model

Lake Palourde (7/16/2006)

Global rate parameters

Organic P:			
Hydrolysis	**0.06**	**/d**	k_{hp}
Temp correction	**1.07**		θ_{hp}
Settling velocity	**0**	**m/d**	v_{op}
Inorganic P:			
Settling velocity	**0**	**m/d**	v_{ip}
Sed P oxygen attenuation half sat constant	**1.7**	**mgO_2/L**	k_{spi}
Phytoplankton:			
Max Growth rate	**5**	**/d**	k_{gp}
Temp correction	**1.07**		θ_{gp}
Respiration rate	**0.1**	**/d**	k_{rp}
Temp correction	**1.07**		θ_{rp}
Death rate	**0**	**/d**	k_{dp}
Temp correction	**1.07**		θ_{dp}
Nitrogen half sat constant	**60**	**ugN/L**	k_{sPp}
Phosphorus half sat constant	**25**	**ugP/L**	k_{sNp}
Inorganic carbon half sat constant	**1.30E-05**	**moles/L**	k_{sCp}
Phytoplankton use HCO3- as substrate	**Yes**		
Light model	**Steele**		
Light constant	**200**	**langleys/d**	K_{Lp}
Ammonia preference	**25**	**ugN/L**	k_{hnxp}
Settling velocity	**0.55**	**m/d**	v_a
Detritus (POM):			
Dissolution rate	**0.003**	**/d**	k_{dt}
Temp correction	**1.07**		θ_{dt}
Settling velocity	**0**	**m/d**	v_{dt}
pH:			
Partial pressure of carbon dioxide	**375**	**ppm**	p_{CO2}

QUAL2Kw (version 5.1)

Stream Water Quality Model

Greg Pelletier, Steve Chapra, and Hua Tao

Department of Ecology and Tufts University

System ID:		
River name	Lake Palourde	
Saved file name	Palourde-Sept-proj-pH85	
Directory where the input/output files are saved	ch\qual2k\qual2kw\qual2kw\v51b37\palourde	
Month	9	
Day	26	
Year	2006	
Time zone	Central	
Daylight savings time	Yes	
Simulation and output options:		
Calculation step	11.25	minutes
Number of days	2000	days
Solution method (integration)	Euler	
Solution method (pH)	Newton-Raphson	
Simulate hyporheic exchange and pore water quality	No	
Display dynamic diel output	Yes	
State variables for simulation	All	
Simulate sediment diagenesis	Yes	
Program determined calc step	11.25	minutes
Time elapsed during last model run	0.52	minutes
Time of sunrise	6:55 AM	
Time of solar noon	12:55 PM	
Time of sunset	6:56 PM	
Photoperiod	12.02	hours

QUAL2Kw

Stream Water Quality Model

Lake Palourde (9/26/2006)

Headwater and Downstream Boundary Data:

Headwater Flow	83.818	m3/s								
Prescribed downstream boundary?	Yes									
Headwater Water Quality	*Units*	*12:00 AM*	*1:00 AM*	*2:00 AM*	*3:00 AM*	*4:00 AM*	*5:00 AM*	*6:00 AM*	*7:00 AM*	*8:00 AM*
Temperature	C	26.30	26.30	26.30	26.30	26.30	26.30	26.30	26.30	26.30
Conductivity	umhos	411.00	411.00	411.00	411.00	411.00	411.00	411.00	411.00	411.00
Inorganic Solids	mgD/L	21.10	21.10	21.10	21.10	21.10	21.10	21.10	21.10	21.10
Dissolved Oxygen	mg/L	7.74	7.74	7.74	7.74	7.74	7.74	7.74	7.74	7.74
CBODslow	mgO2/L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CBODfast	mgO2/L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Organic Nitrogen	ugN/L	1589.40	1589.40	1589.40	1589.40	1589.40	1589.40	1589.40	1589.40	1589.40
NH4-Nitrogen	ugN/L	45.00	45.00	45.00	45.00	45.00	45.00	45.00	45.00	45.00
NO3-Nitrogen	ugN/L	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00
Organic Phosphorus	ugP/L	159.03	159.03	159.03	159.03	159.03	159.03	159.03	159.03	159.03
Inorganic Phosphorus (SRP)	ugP/L	79.47	79.47	79.47	79.47	79.47	79.47	79.47	79.47	79.47
Phytoplankton	ugA/L	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
Detritus (POM)	mgD/L	11.40	11.40	11.40	11.40	11.40	11.40	11.40	11.40	11.40
Pathogen	cfu/100 mL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Generic constituent	user defined	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Alkalinity	mgCaCO3/L	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00
pH	s.u.	8.80	8.80	8.80	8.80	8.80	8.80	8.80	8.80	8.80
Downstream Boundary Water Quality (optional)	*Units*	*12:00 AM*	*1:00 AM*	*2:00 AM*	*3:00 AM*	*4:00 AM*	*5:00 AM*	*6:00 AM*	*7:00 AM*	*8:00 AM*
Temperature	C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Conductivity	umhos	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Inorganic Solids	mgD/L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dissolved Oxygen	mg/L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CBODslow	mgO2/L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CBODfast	mgO2/L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Organic Nitrogen	ugN/L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NH4-Nitrogen	ugN/L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NO3-Nitrogen	ugN/L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Organic Phosphorus	ugP/L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Inorganic Phosphorus (SRP)	ugP/L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Phytoplankton	ugA/L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Detritus (POM)	mgD/L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pathogen	cfu/100 mL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Generic constituent	user defined	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Alkalinity	mgCaCO3/L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
pH	s.u.	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00

QUAL2Kw

Stream Water Quality Model

Lake Palourde (9/26/2006)

Reach Data:

Reach for diel plot:	2							
			Reach			*Downstream*	*Elevation*	
Reach	*Downstream*		*length*	*Downstream*		*location*	*Upstream*	*Downstream*
Label	*end of reach label*	*Number*	*(km)*	*Latitude*	*Longitude*	*(km)*	*(m)*	*(m)*
	Headwater					7.500		1.000
Lake Palourde 1						7.400	1.000	1.000
Lake Palourde 2						0.000	1.000	1.000

						Hydraulic Model (Weir Overrides Rating Curves; F					
Downstream						*Weir*		Rating Curves			
Latitude			*Longitude*			*Height*	*Width*	*Velocity*		Depth	
Degrees	*Minutes*	*Seconds*	*Degrees*	*Minutes*	*Seconds*	*(m)*	*(m)*	*Coefficient*	*Exponent*	*Coefficient*	*Exponent*
29	45	10	91	7	7	0.0000	0.000	0.0001	1.000	2.0000	0.000
29	44	3	91	7	40	0.0000	0.000	0.0001	1.000	2.0000	0.000
29	42	42	91.00	7	19	0.0000	0.000	0.0001	1.000	2.0000	0.000

Rating Curves Override Manning Formula)										
Manning Formula					Prescribed	Bottom	Bottom	Prescribed	Prescribed	Prescribed
Channel	Manning	Bot Width	Side	Side	Dispersion	Algae	SOD	SOD	CH4 flux	NH4 flux
Slope	n	m	Slope	Slope	m2/s	Coverage	Coverage	gO2/m2/d	gO2/m2/d	mgN/m2/d
0.00	0	0.0000	0.00	0.0000	0.000					
0.00	0	0.0000	0.00	0.0000	0.000	0%	100%	0.00	0.0000	0.0000
0.00	0	0.0000	0.00	0.0000	0.000	0%	100%	0.00	0.0000	0.0000

Prescribed	Sediment	Sediment	Sediment/hyporheic	Hyporheic	Hyporheic
Inorg P flux	thermal cond	thermal diff	zone thickness	exchange flow	sediment porosity
mgP/m2/d	(W/m/degC)	(cm^2/sec)	(cm)	(fraction of stream flow)	(fraction of volume)
0.0000	1.6	0.0064	10	0%	40%
0.0000	1.6	0.0064	10	0%	40%

QUAL2Kw

Stream Water Quality Model

Lake Palourde (9/26/2006)

Air Temperature Data:

				Upstream	Downstream	12:00 AM	1:00 AM	2:00 AM
Upstream	Reach	Downstream	Reach	Distance	Distance	Hourly air temperature for each reach		
Label	Label	Label	Number	km	km	(The input values are applied as poin		
Headwater	Lake Palourde 1		1	7.50	7.40	19.88	18.30	16.93
	Lake Palourde 2		2	7.40	0.00	19.88	18.30	16.93

3:00 AM	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM
(degrees C)										
t estimates at each time. Linear interpolation is used to estimate values between the hourly inputs.)										
15.89	15.23	15.00	15.22	15.87	16.91	18.27	19.85	21.55	23.25	24.84
15.89	15.23	15.00	15.22	15.87	16.91	18.27	19.85	21.55	23.25	24.84

2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM	10:00 PM	11:00 PM
26.21	27.26	27.92	28.15	27.93	27.28	26.24	24.89	23.31	21.61
26.21	27.26	27.92	28.15	27.93	27.28	26.24	24.89	23.31	21.61

QUAL2Kw

Stream Water Quality Model

Lake Palourde (9/26/2006)

Dew Point Temperature Data:

				Upstream	Downstream	12:00 AM	1:00 AM	2:00 AM
Upstream	Reach	Downstream	Reach	Distance	Distance	Hourly dewpoint temperature for eac		
Label	Label	Label	Number	km	km	(The input values are applied as poin		
Headwater	Lake Palourde 1		1	7.50	7.40	15.71	14.46	13.37
	Lake Palourde 2		2	7.40	0.00	15.71	14.46	13.37

3:00 AM	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM
h reach (degrees C)										
t estimates at each time. Linear interpolation is used to estimate values between the hourly inputs.)										
12.55	12.03	11.85	12.02	12.54	13.36	14.43	15.68	17.02	18.37	19.62
12.55	12.03	11.85	12.02	12.54	13.36	14.43	15.68	17.02	18.37	19.62

2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM	10:00 PM	11:00 PM
20.71	21.54	22.06	22.24	22.06	21.55	20.73	19.66	18.41	17.07
20.71	21.54	22.06	22.24	22.06	21.55	20.73	19.66	18.41	17.07

QUAL2Kw

Stream Water Quality Model

Lake Palourde (9/26/2006)

Wind Speed Data:

				Upstream	Downstream	12:00 AM	1:00 AM	2:00 AM
Upstream	Reach	Downstream	Reach	Distance	Distance	Wind speed for each reach 7m above		
Label	Label	Label	Number	km	km	(The input values are applied as poin		
Headwater	Lake Palourde 1		1	7.50	7.40	2.02	2.02	2.02
	Lake Palourde 2		2	7.40	0.00	2.02	2.02	2.02

3:00 AM	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM
water surface (m/s)										
t estimates at each time. Linear interpolation is used to estimate values between the hourly inputs.)										
2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02
2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02

2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM	10:00 PM	11:00 PM
2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02
2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02

QUAL2Kw

Stream Water Quality Model

Lake Palourde (9/26/2006)

Cloud Cover Data:

				Upstream	Downstream	12:00 AM	1:00 AM	2:00 AM
Upstream	Reach	Downstream	Reach	Distance	Distance	Hourly cloud cover shade for each re		
Label	Label	Label	Number	km	km	(Percent of sky that is covered by clo		
Headwater	Lake Palourde 1		1	7.50	7.40	3.0%	3.0%	3.0%
	Lake Palourde 2		2	7.40	0.00	3.0%	3.0%	3.0%

3:00 AM	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM
ach (Percent)										
uds. The input values are applied as point estimates at each time. Linear interpolation is used to estimate values between the hourly inpu										
3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%

2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM	10:00 PM	11:00 PM
ts.)									
3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%

QUAL2Kw

Stream Water Quality Model

Lake Palourde (9/26/2006)

Light Parameters and Surface Heat Transfer Models:

Parameter	*Value*	*Unit*	
Photosynthetically Available Radiation	0.47		
Background light extinction	0.2	/m	k_{eb}
Linear chlorophyll light extinction	0.0088	1/m-(ugA/L)	α_p
Nonlinear chlorophyll light extinction	0.054	$1/m\text{-}(ugA/L)^{2/3}$	α_{pn}
ISS light extinction	0.052	1/m-(mgD/L)	α_i
Detritus light extinction	0.174	1/m-(mgD/L)	α_o
Macrophyte light extinction	0	$1/m\text{-}(gD/m^3)$	α_{mac}
Solar shortwave radiation model			
Atmospheric attenuation model for solar	Bras		
Bras solar parameter (used if Bras solar model is selected)			
atmospheric turbidity coefficient (2=clear, 5=smoggy, default=2)	4		n_{fac}
Ryan-Stolzenbach solar parameter (used if Ryan-Stolzenbach solar model is selected)			
atmospheric transmission coefficient (0.70-0.91, default 0.8)	0.8		a_{tc}
Downwelling atmospheric longwave IR radiation			
atmospheric longwave emissivity model	Koberg		
Evaporation and air convection/conduction			
wind speed function for evaporation and air convection/conduction	Adams 1		

QUAL2Kw

Stream Water Quality Model

Lake Palourde (9/26/2006)

Point Source Data:

		Point	Point	Temperature		
		Abstraction	Inflow	mean	range/2	time of
Name	Location (km)	m3/s	m3/s	°C	°C	max
Morgan City MS4	3.80	0.0000	0.3720	32.40	0.00	12:00 AM

Specific Conductance			Inorganic Suspended Solids			Dissolved Oxygen		
mean	range/2	time of	mean	range/2	time of	mean	range/2	time of
umhos	umhos	max	mg/L	mg/L	max	mg/L	mg/L	max
384.00	0.00	12:00 AM	14.17	0.00	12:00 AM	8.61	0.00	12:00 AM

Slow CBOD			Fast CBOD			Organic N		
mean	range/2	time of	mean	range/2	time of	mean	range/2	time of
mgO2/L	mgO2/L	max	mgO2/L	mgO2/L	max	ugN/L	ugN/L	max
0.00	0.00	12:00 AM	0.00	0.00	12:00 AM	1916.00	0.00	12:00 AM

Ammonia N			Nitrate + Nitrite N			Organic P		
mean	range/2	time of	mean	range/2	time of	mean	range/2	time of
ugN/L	ugN/L	max	ugN/L	ugN/L	max	ugP/L	ugP/L	max
60.00	0.00	12:00 AM	24.00	0.00	12:00 AM	200.00	0.00	12:00 AM

Inorganic P			Phytoplankton			Detritus		
mean	range/2	time of	mean	range/2	time of	mean	range/2	time of
ugP/L	ugP/L	max	ugA/L	ugA/L	max	mgD/L	mgD/L	max
100.00	0.00	12:00 AM	66.5	0.00	12:00 AM	10.8	0.00	12:00 AM

Pathogen Indicator Bacteria			Generic constituent			Alkalinity		
mean	range/2	time of	mean	range/2	time of	mean	range/2	time of
cfu/100ml	cfu/100ml	max	user defined	user defined	max	mgCaCO3/L	mgCaCO3/L	max
0.0	0.00	12:00 AM	0.0	0.00	12:00 AM	105.0	0.00	12:00 AM

pH		
mean	range/2	time of
s.u.	s.u.	max
9.2	0.00	12:00 AM

QUAL2Kw

Stream Water Quality Model

Lake Palourde (9/26/2006)

Diffuse Source Data:

			Diffuse	Diffuse		Spec	Inorg	Diss	CBOD
			Abstraction	Inflow	Temp	Cond	SS	Oxygen	slow
Name	Up (km)	Down (km)	m3/s	m3/s	C	umhos	mgD/L	mg/L	mgO2/L
Nonpoint Sources	7.50	0.00	0.0000	0.0043	32.40	384.00	14.17	8.61	0.00

CBOD	Organic	Ammon	Nitrate	Organic	Inorganic	Phyto			Generic		
fast	N	N	N	P	P	plankton	Detritus	Pathogen	constituent	Alk	pH
mgO2/L	ugN/L	ugN/L	ugN/L	ugP/L	ugP/L	ug/L	mgD/L	cfu/100 mL	user defined	mgCaCO3/L	
0.00	0.0	0.0	0.0	0.0	0.0	66.5	10.8	0.0	0.0	105.0	9.2

QUAL2Kw

Stream Water Quality Model

Lake Palourde (9/26/2006)

Global rate parameters

Parameter	*Value*	*Units*	*Symbol*
Stoichiometry:			
Carbon	40	gC	gC
Nitrogen	7.2	gN	gN
Phosphorus	1	gP	gP
Dry weight	100	gD	gD
Chlorophyll	0.5	gA	gA
Inorganic suspended solids:			
Settling velocity	0	m/d	v_i
Oxygen:			
Reaeration model	Internal		
Temp correction	1.024		θ_a
Reaeration wind effect	Wanninkhof		
O2 for carbon oxidation	2.69	gO_2/gC	r_{oc}
O2 for NH4 nitrification	4.57	gO_2/gN	r_{on}
Oxygen inhib model CBOD oxidation	Exponential		
Oxygen inhib parameter CBOD oxidation	0.60	L/mgO2	K_{socf}
Oxygen inhib model nitrification	Exponential		
Oxygen inhib parameter nitrification	0.60	L/mgO2	K_{sona}
Oxygen enhance model denitrification	Exponential		
Oxygen enhance parameter denitrification	0.60	L/mgO2	K_{sodn}
Oxygen inhib model phyto resp	Exponential		
Oxygen inhib parameter phyto resp	0.60	L/mgO2	K_{sop}
Oxygen enhance model bot alg resp	Exponential		
Oxygen enhance parameter bot alg resp	0.60	L/mgO2	K_{sob}
Slow CBOD:			
Hydrolysis rate	0.6	/d	k_{hc}
Temp correction	1.047		θ_{hc}
Oxidation rate	0	/d	k_{dcs}
Temp correction	1.047		θ_{dcs}
Fast CBOD:			
Oxidation rate	0.9	/d	k_{dc}
Temp correction	1.047		θ_{dc}
Organic N:			
Hydrolysis	0.01	/d	k_{hn}
Temp correction	1.07		θ_{hn}
Settling velocity	0	m/d	v_{on}
Ammonium:			
Nitrification	2	/d	k_{na}
Temp correction	1.07		θ_{na}
Nitrate:			
Denitrification	0.06	/d	k_{dn}
Temp correction	1.07		θ_{dn}
Sed denitrification transfer coeff	0.03	m/d	v_{di}
Temp correction	1.07		θ_{di}

QUAL2Kw

Stream Water Quality Model

Lake Palourde (9/26/2006)

Global rate parameters

Organic P:			
Hydrolysis	**0.06**	**/d**	k_{hp}
Temp correction	**1.07**		θ_{hp}
Settling velocity	**0**	**m/d**	v_{op}
Inorganic P:			
Settling velocity	**0**	**m/d**	v_{ip}
Sed P oxygen attenuation half sat constant	**1.7**	**mgO$_2$/L**	k_{spi}
Phytoplankton:			
Max Growth rate	**5**	**/d**	k_{gp}
Temp correction	**1.07**		θ_{gp}
Respiration rate	**0.1**	**/d**	k_{rp}
Temp correction	**1.07**		θ_{rp}
Death rate	**0**	**/d**	k_{dp}
Temp correction	**1.07**		θ_{dp}
Nitrogen half sat constant	**60**	**ugN/L**	k_{sPp}
Phosphorus half sat constant	**25**	**ugP/L**	k_{sNp}
Inorganic carbon half sat constant	**1.30E-05**	**moles/L**	k_{sCp}
Phytoplankton use HCO3- as substrate	**Yes**		
Light model	**Steele**		
Light constant	**200**	**langleys/d**	K_{Lp}
Ammonia preference	**25**	**ugN/L**	k_{hnxp}
Settling velocity	**0.55**	**m/d**	v_a
Detritus (POM):			
Dissolution rate	**0.003**	**/d**	k_{dt}
Temp correction	**1.07**		θ_{dt}
Settling velocity	**0**	**m/d**	v_{dt}
pH:			
Partial pressure of carbon dioxide	**375**	**ppm**	p_{CO2}

QUAL2Kw (version 5.1)

Stream Water Quality Model

Greg Pelletier, Steve Chapra, and Hua Tao

Department of Ecology and Tufts University

System ID:		
River name	Bayou Avoca	
Saved file name	Avoca-July_projection	
Directory where the input/output files are saved	ual2k\qual2kw\qual2kw\v51b37\Chene-Avoca	
Month	7	
Day	16	
Year	2006	
Time zone	Central	
Daylight savings time	No	
Simulation and output options:		
Calculation step	11.25	minutes
Number of days	2000	days
Solution method (integration)	Euler	
Solution method (pH)	Newton-Raphson	
Simulate hyporheic exchange and pore water quality	No	
Display dynamic diel output	Yes	
State variables for simulation	All	
Simulate sediment diagenesis	Yes	
Program determined calc step	11.25	minutes
Time elapsed during last model run	0.41	minutes
Time of sunrise	5:15 AM	
Time of solar noon	12:11 PM	
Time of sunset	7:06 PM	
Photoperiod	13.84	hours

QUAL2Kw

Stream Water Quality Model

Bayou Avoca (7/16/2006)

Headwater and Downstream Boundary Data:

Headwater Flow	5.012	m3/s								
Prescribed downstream boundary?	No									
Headwater Water Quality	*Units*	*12:00 AM*	*1:00 AM*	*2:00 AM*	*3:00 AM*	*4:00 AM*	*5:00 AM*	*6:00 AM*	*7:00 AM*	*8:00 AM*
Temperature	C	31.04	31.04	31.04	31.04	31.04	31.04	31.04	31.04	31.04
Conductivity	umhos	458.00	458.00	458.00	458.00	458.00	458.00	458.00	458.00	458.00
Inorganic Solids	mgD/L	6.38	6.38	6.38	6.38	6.38	6.38	6.38	6.38	6.38
Dissolved Oxygen	mg/L	7.97	7.97	7.97	7.97	7.97	7.97	7.97	7.97	7.97
CBODslow	mgO2/L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CBODfast	mgO2/L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Organic Nitrogen	ugN/L	1413.00	1413.00	1413.00	1413.00	1413.00	1413.00	1413.00	1413.00	1413.00
NH4-Nitrogen	ugN/L	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
NO3-Nitrogen	ugN/L	1215.00	1215.00	1215.00	1215.00	1215.00	1215.00	1215.00	1215.00	1215.00
Organic Phosphorus	ugP/L	96.70	96.70	96.70	96.70	96.70	96.70	96.70	96.70	96.70
Inorganic Phosphorus (SRP)	ugP/L	48.30	48.30	48.30	48.30	48.30	48.30	48.30	48.30	48.30
Phytoplankton	ugA/L	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00
Detritus (POM)	mgD/L	9.12	9.12	9.12	9.12	9.12	9.12	9.12	9.12	9.12
Pathogen	cfu/100 mL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Generic constituent	user defined	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Alkalinity	mgCaCO3/L	115.00	115.00	115.00	115.00	115.00	115.00	115.00	115.00	115.00
pH	s.u.	8.43	8.43	8.43	8.43	8.43	8.43	8.43	8.43	8.43
Downstream Boundary Water Quality (optional)	*Units*	*12:00 AM*	*1:00 AM*	*2:00 AM*	*3:00 AM*	*4:00 AM*	*5:00 AM*	*6:00 AM*	*7:00 AM*	*8:00 AM*
Temperature	C									
Conductivity	umhos									
Inorganic Solids	mgD/L									
Dissolved Oxygen	mg/L									
CBODslow	mgO2/L									
CBODfast	mgO2/L									
Organic Nitrogen	ugN/L									
NH4-Nitrogen	ugN/L									
NO3-Nitrogen	ugN/L									
Organic Phosphorus	ugP/L									
Inorganic Phosphorus (SRP)	ugP/L									
Phytoplankton	ugA/L									
Detritus (POM)	mgD/L									
Pathogen	cfu/100 mL									
Generic constituent	user defined									
Alkalinity	mgCaCO3/L									
pH	s.u.									

QUAL2Kw

Stream Water Quality Model

Bayou Avoca (7/16/2006)

Reach Data:

Reach for diel plot:	2							
			Reach			*Downstream*	*Elevation*	
Reach	*Downstream*		*length*	*Downstream*		*location*	*Upstream*	*Downstream*
Label	*end of reach label*	*Number*	*(km)*	*Latitude*	*Longitude*	*(km)*	*(m)*	*(m)*
	Headwater	0		29.63	91.08	23.000		1.000
Bayou Avoca 1		1	0.10	29.63	91.08	22.900	1.000	1.000
Bayou Avoca 2		2	22.90	29.54	91.25	0.000	1.000	1.000

						Hydraulic Model (Weir Overrides Rating Curves; F					
Downstream						*Weir*		Rating Curves			
Latitude			*Longitude*			*Height*	*Width*	*Velocity*		Depth	
Degrees	*Minutes*	*Seconds*	*Degrees*	*Minutes*	*Seconds*	*(m)*	*(m)*	*Coefficient*	*Exponent*	*Coefficient*	*Exponent*
29	37	36	91	4	58	0.0000	0.000	0.0006	1.000	3.6576	0.00
29	37	36	91	4	58	0.0000	0.000	0.0006	1.000	3.6576	0.00
29	32	24	91	14	54	0.0000	0.000	0.0006	1.000	3.6576	0.00

Rating Curves Override Manning Formula)										
Manning Formula					Prescribed	Bottom	Bottom	Prescribed	Prescribed	Prescribed
Channel	Manning	Bot Width	Side	Side	Dispersion	Algae	SOD	SOD	CH4 flux	NH4 flux
Slope	n	m	Slope	Slope	m2/s	Coverage	Coverage	gO2/m2/d	gO2/m2/d	mgN/m2/d
0.00	0	0.0000	0.00	0.0000	0.000					
0.00	0	0.0000	0.00	0.0000	0.000	0%	100%	0.00	0.0000	0.0000
0.00	0	0.0000	0.00	0.0000	0.000	0%	100%	0.00	0.0000	0.0000

Prescribed	Sediment	Sediment	Sediment/hyporheic	Hyporheic	Hyporheic
Inorg P flux	thermal cond	thermal diff	zone thickness	exchange flow	sediment porosity
mgP/m2/d	(W/m/degC)	(cm^2/sec)	(cm)	(fraction of stream flow)	(fraction of volume)
0.0000	1.6	0.0064	10	0%	40%
0.0000	1.6	0.0064	10	0%	40%

QUAL2Kw

Stream Water Quality Model

Bayou Avoca (7/16/2006)

Air Temperature Data:

				Upstream	Downstream	12:00 AM	1:00 AM	2:00 AM
Upstream	Reach	Downstream	Reach	Distance	Distance	Hourly air temperature for each reach		
Label	Label	Label	Number	km	km	(The input values are applied as poin		
Headwater	Bayou Avoca 1		1	23.00	22.90	28.85	27.70	26.82
	Bayou Avoca 2		2	22.90	0.00	28.85	27.70	26.82

3:00 AM	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM
(degrees C)										
t estimates at each time. Linear interpolation is used to estimate values between the hourly inputs.)										
26.23	25.92	25.82	25.91	26.23	26.80	27.68	28.83	30.15	31.47	32.63
26.23	25.92	25.82	25.91	26.23	26.80	27.68	28.83	30.15	31.47	32.63

2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM	10:00 PM	11:00 PM
33.51	34.10	34.41	34.51	34.42	34.11	33.54	32.66	31.51	30.19
33.51	34.10	34.41	34.51	34.42	34.11	33.54	32.66	31.51	30.19

QUAL2Kw

Stream Water Quality Model

Bayou Avoca (7/16/2006)

Dew Point Temperature Data: -3

				Upstream	Downstream	12:00 AM	1:00 AM	2:00 AM
Upstream	Reach	Downstream	Reach	Distance	Distance	Hourly dewpoint temperature for eac		
Label	Label	Label	Number	km	km	(The input values are applied as poin		
Headwater	Bayou Avoca 1		1	23.00	22.90	15.18	14.45	13.90
	Bayou Avoca 2		2	22.90	0.00	15.18	14.45	13.90

3:00 AM	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM
h reach (degrees C)										
t estimates at each time. Linear interpolation is used to estimate values between the hourly inputs.)										
13.52	13.33	13.27	13.32	13.52	13.88	14.44	15.16	15.99	16.83	17.56
13.52	13.33	13.27	13.32	13.52	13.88	14.44	15.16	15.99	16.83	17.56

2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM	10:00 PM	11:00 PM
18.11	18.48	18.68	18.74	18.68	18.49	18.13	17.58	16.85	16.02
18.11	18.48	18.68	18.74	18.68	18.49	18.13	17.58	16.85	16.02

QUAL2Kw

Stream Water Quality Model

Bayou Avoca (7/16/2006)

Wind Speed Data:

				Upstream	Downstream	12:00 AM	1:00 AM	2:00 AM
Upstream	Reach	Downstream	Reach	Distance	Distance	Wind speed for each reach 7m above		
Label	Label	Label	Number	km	km	(The input values are applied as poin		
Headwater	Bayou Avoca 1		1	23.00	22.90	1.43	1.43	1.43
	Bayou Avoca 2		2	22.90	0.00	1.43	1.43	1.43

3:00 AM	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM
water surface (m/s)										
t estimates at each time. Linear interpolation is used to estimate values between the hourly inputs.)										
1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43
1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43

2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM	10:00 PM	11:00 PM
1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43
1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43

QUAL2Kw

Stream Water Quality Model

Bayou Avoca (7/16/2006)

Cloud Cover Data:

				Upstream	Downstream	12:00 AM	1:00 AM	2:00 AM	3:00 AM	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM
Upstream	Reach	Downstream	Reach	Distance	Distance	Hourly cloud cover shade for each re			ach (Percent)										
Label	Label	Label	Number	km	km	(Percent of sky that is covered by clo			uds. The input values are applied as point estimates at each time. Linear interpolation is used to estimate values between the hourly inpu										
Headwater	Bayou Avoca 1		1	23.00	22.90	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%
	Bayou Avoca 2		2	22.90	0.00	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%

2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM	10:00 PM	11:00 PM
ts.)									
15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%
15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%

QUAL2Kw

Stream Water Quality Model

Bayou Avoca (7/16/2006)

Light Parameters and Surface Heat Transfer Models:

Parameter	*Value*	*Unit*	
Photosynthetically Available Radiation	0.47		
Background light extinction	0.2	/m	k_{eb}
Linear chlorophyll light extinction	0.0088	1/m-(ugA/L)	α_p
Nonlinear chlorophyll light extinction	0.054	$1/m\text{-}(ugA/L)^{2/3}$	α_{pn}
ISS light extinction	0.052	1/m-(mgD/L)	α_i
Detritus light extinction	0.174	1/m-(mgD/L)	α_o
Macrophyte light extinction	0	$1/m\text{-}(gD/m^3)$	α_{mac}
Solar shortwave radiation model			
Atmospheric attenuation model for solar	Bras		
Bras solar parameter (used if Bras solar model is selected)			
atmospheric turbidity coefficient (2=clear, 5=smoggy, default=2)	4		n_{fac}
Ryan-Stolzenbach solar parameter (used if Ryan-Stolzenbach solar model is selected)			
atmospheric transmission coefficient (0.70-0.91, default 0.8)	0.8		a_{tc}
Downwelling atmospheric longwave IR radiation			
atmospheric longwave emissivity model	Koberg		
Evaporation and air convection/conduction			
wind speed function for evaporation and air convection/conduction	Adams 1		

QUAL2Kw

Stream Water Quality Model

Bayou Avoca (7/16/2006)

Diffuse Source Data:

			Diffuse	Diffuse		Spec	Inorg	Diss	CBOD	CBOD
			Abstraction	Inflow	Temp	Cond	SS	Oxygen	slow	fast
Name	Up (km)	Down (km)	m3/s	m3/s	C	umhos	mgD/L	mg/L	mgO2/L	mgO2/L
	22.90	0.00	0.0000	0.0056	31.70	458.00	6.38	7.97	0.00	0.00

Organic	Ammon	Nitrate	Organic	Inorganic	Phyto			Generic		
N	N	N	P	P	plankton	Detritus	Pathogen	constituent	Alk	pH
ugN/L	ugN/L	ugN/L	ugP/L	ugP/L	ug/L	mgD/L	cfu/100 mL	user defined	mgCaCO3/L	
390000.00	7.50	182.25	172500.00	7.25	40.00	25000.00	0.00	0.00	115.00	8.43

QUAL2Kw

Stream Water Quality Model

Bayou Avoca (7/16/2006)

Global rate parameters

Parameter	*Value*	*Units*	*Symbol*
Stoichiometry:			
Carbon	40	gC	gC
Nitrogen	7.2	gN	gN
Phosphorus	1	gP	gP
Dry weight	100	gD	gD
Chlorophyll	0.5	gA	gA
Inorganic suspended solids:			
Settling velocity	0	m/d	v_i
Oxygen:			
Reaeration model	Internal		
Temp correction	1.024		θ_a
Reaeration wind effect	Wanninkhof		
O2 for carbon oxidation	2.69	gO_2/gC	r_{oc}
O2 for NH4 nitrification	4.57	gO_2/gN	r_{on}
Oxygen inhib model CBOD oxidation	Exponential		
Oxygen inhib parameter CBOD oxidation	0.60	L/mgO2	K_{socf}
Oxygen inhib model nitrification	Exponential		
Oxygen inhib parameter nitrification	0.60	L/mgO2	K_{sona}
Oxygen enhance model denitrification	Exponential		
Oxygen enhance parameter denitrification	0.60	L/mgO2	K_{sodn}
Oxygen inhib model phyto resp	Exponential		
Oxygen inhib parameter phyto resp	0.60	L/mgO2	K_{sop}
Oxygen enhance model bot alg resp	Exponential		
Oxygen enhance parameter bot alg resp	0.60	L/mgO2	K_{sob}
Slow CBOD:			
Hydrolysis rate	0.6	/d	k_{hc}
Temp correction	1.047		θ_{hc}
Oxidation rate	0	/d	k_{dcs}
Temp correction	1.047		θ_{dcs}
Fast CBOD:			
Oxidation rate	0.9	/d	k_{dc}
Temp correction	1.047		θ_{dc}
Organic N:			
Hydrolysis	0.01	/d	k_{hn}
Temp correction	1.07		θ_{hn}
Settling velocity	0	m/d	v_{on}
Ammonium:			
Nitrification	2	/d	k_{na}
Temp correction	1.07		θ_{na}
Nitrate:			
Denitrification	0.06	/d	k_{dn}
Temp correction	1.07		θ_{dn}
Sed denitrification transfer coeff	0.03	m/d	v_{di}
Temp correction	1.07		θ_{di}

QUAL2Kw

Stream Water Quality Model

Bayou Avoca (7/16/2006)

Global rate parameters

Organic P:			
Hydrolysis	0.06	/d	k_{hp}
Temp correction	1.07		θ_{hp}
Settling velocity	0	m/d	v_{op}
Inorganic P:			
Settling velocity	0	m/d	v_{ip}
Sed P oxygen attenuation half sat constant	1.7	mgO_2/L	k_{spi}
Phytoplankton:			
Max Growth rate	5	/d	k_{gp}
Temp correction	1.07		θ_{gp}
Respiration rate	0.1	/d	k_{rp}
Temp correction	1.07		θ_{rp}
Death rate	0	/d	k_{dp}
Temp correction	1.07		θ_{dp}
Nitrogen half sat constant	60	ugN/L	k_{sPp}
Phosphorus half sat constant	25	ugP/L	k_{sNp}
Inorganic carbon half sat constant	1.30E-05	moles/L	k_{sCp}
Phytoplankton use HCO3- as substrate	Yes		
Light model	Steele		
Light constant	200	langleys/d	K_{Lp}
Ammonia preference	25	ugN/L	k_{hnxp}
Settling velocity	0.55	m/d	v_a
Detritus (POM):			
Dissolution rate	0.003	/d	k_{dt}
Temp correction	1.07		θ_{dt}
Settling velocity	0	m/d	v_{dt}
pH:			
Partial pressure of carbon dioxide	375	ppm	p_{CO2}

QUAL2Kw (version 5.1)

Stream Water Quality Model

Greg Pelletier, Steve Chapra, and Hua Tao

Department of Ecology and Tufts University

System ID:		
River name	Bayou Avoca	
Saved file name	Avoca-Sep_projection	
Directory where the input/output files are saved		
Month	9	
Day	26	
Year	2006	
Time zone	Central	
Daylight savings time	No	
Simulation and output options:		
Calculation step	11.25	minutes
Number of days	2000	days
Solution method (integration)	Euler	
Solution method (pH)	Newton-Raphson	
Simulate hyporheic exchange and pore water quality	No	
Display dynamic diel output	Yes	
State variables for simulation	All	
Simulate sediment diagenesis	Yes	
Program determined calc step	11.25	minutes
Time elapsed during last model run	0.42	minutes
Time of sunrise	5:55 AM	
Time of solar noon	11:56 AM	
Time of sunset	5:56 PM	
Photoperiod	12.02	hours

QUAL2Kw

Stream Water Quality Model

Bayou Avoca (9/26/2006)

Headwater and Downstream Boundary Data:

Headwater Flow	5.012	m3/s								
Prescribed downstream boundary?	No									
Headwater Water Quality	*Units*	*12:00 AM*	*1:00 AM*	*2:00 AM*	*3:00 AM*	*4:00 AM*	*5:00 AM*	*6:00 AM*	*7:00 AM*	*8:00 AM*
Temperature	C	27.53	27.53	27.53	27.53	27.53	27.53	27.53	27.53	27.53
Conductivity	umhos	565.00	565.00	565.00	565.00	565.00	565.00	565.00	565.00	565.00
Inorganic Solids	mgD/L	24.38	24.38	24.38	24.38	24.38	24.38	24.38	24.38	24.38
Dissolved Oxygen	mg/L	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62	6.62
CBODslow	mgO2/L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CBODfast	mgO2/L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Organic Nitrogen	ugN/L	1268.00	1268.00	1268.00	1268.00	1268.00	1268.00	1268.00	1268.00	1268.00
NH4-Nitrogen	ugN/L	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
NO3-Nitrogen	ugN/L	255.00	255.00	255.00	255.00	255.00	255.00	255.00	255.00	255.00
Organic Phosphorus	ugP/L	146.70	146.70	146.70	146.70	146.70	146.70	146.70	146.70	146.70
Inorganic Phosphorus (SRP)	ugP/L	73.30	73.30	73.30	73.30	73.30	73.30	73.30	73.30	73.30
Phytoplankton	ugA/L	71.00	71.00	71.00	71.00	71.00	71.00	71.00	71.00	71.00
Detritus (POM)	mgD/L	9.12	9.12	9.12	9.12	9.12	9.12	9.12	9.12	9.12
Pathogen	cfu/100 mL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Generic constituent	user defined									
Alkalinity	mgCaCO3/L	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00
pH	s.u.	8.12	8.12	8.12	8.12	8.12	8.12	8.12	8.12	8.12
Downstream Boundary Water Quality (optional)	*Units*	*12:00 AM*	*1:00 AM*	*2:00 AM*	*3:00 AM*	*4:00 AM*	*5:00 AM*	*6:00 AM*	*7:00 AM*	*8:00 AM*
Temperature	C									
Conductivity	umhos									
Inorganic Solids	mgD/L									
Dissolved Oxygen	mg/L									
CBODslow	mgO2/L									
CBODfast	mgO2/L									
Organic Nitrogen	ugN/L									
NH4-Nitrogen	ugN/L									
NO3-Nitrogen	ugN/L									
Organic Phosphorus	ugP/L									
Inorganic Phosphorus (SRP)	ugP/L									
Phytoplankton	ugA/L									
Detritus (POM)	mgD/L									
Pathogen	cfu/100 mL									
Generic constituent	user defined									
Alkalinity	mgCaCO3/L									
pH	s.u.									

QUAL2Kw

Stream Water Quality Model

Bayou Avoca (9/26/2006)

Reach Data:

Reach for diel plot:	2							
			Reach			*Downstream*	*Elevation*	
Reach	*Downstream*		*length*	*Downstream*		*location*	*Upstream*	*Downstream*
Label	*end of reach label*	*Number*	*(km)*	*Latitude*	*Longitude*	*(km)*	*(m)*	*(m)*
	Headwater	0		29.63	91.08	23.000		1.000
Bayou Avoca 1		1	0.10	29.63	91.08	22.900	1.000	1.000
Bayou Avoca 2		2	22.90	29.54	91.25	0.000	1.000	1.000

						Hydraulic Model (Weir Overrides Rating Curves; F					
Downstream						*Weir*		Rating Curves			
Latitude			*Longitude*			*Height*	*Width*	*Velocity*		Depth	
Degrees	*Minutes*	*Seconds*	*Degrees*	*Minutes*	*Seconds*	*(m)*	*(m)*	*Coefficient*	*Exponent*	*Coefficient*	*Exponent*
29	37	36	91	4	58			0.0006	1.000	3.6576	0.00
29	37	36	91	4	58			0.0006	1.000	3.6576	0.00
29	32	24	91	14	54			0.0006	1.000	3.6576	0.00

Rating Curves Override Manning Formula)										
Manning Formula					Prescribed	Bottom	Bottom	Prescribed	Prescribed	Prescribed
Channel	Manning	Bot Width	Side	Side	Dispersion	Algae	SOD	SOD	CH4 flux	NH4 flux
Slope	n	m	Slope	Slope	m2/s	Coverage	Coverage	gO2/m2/d	gO2/m2/d	mgN/m2/d
0.00	0	0.0000	0.00	0.0000						
0.00	0	0.0000	0.00	0.0000	0.000	0%	100%	0.00	0.0000	0.0000
0.00	0	0.0000	0.00	0.0000	0.000	0%	100%	0.00	0.0000	0.0000

Prescribed	Sediment	Sediment	Sediment/hyporheic	Hyporheic	Hyporheic
Inorg P flux	thermal cond	thermal diff	zone thickness	exchange flow	sediment porosity
mgP/m2/d	(W/m/degC)	(cm^2/sec)	(cm)	(fraction of stream flow)	(fraction of volume)
0.0000	1.6	0.0064	10	0%	40%
0.0000	1.6	0.0064	10	0%	40%

QUAL2Kw

Stream Water Quality Model

Bayou Avoca (9/26/2006)

Air Temperature Data:

				Upstream	Downstream	12:00 AM	1:00 AM	2:00 AM
Upstream	Reach	Downstream	Reach	Distance	Distance	Hourly air temperature for each reach		
Label	Label	Label	Number	km	km	(The input values are applied as poin		
Headwater	Bayou Avoca 1		1	23.00	22.90	19.88	18.30	16.93
	Bayou Avoca 2		2	22.90	0.00	19.88	18.30	16.93

3:00 AM	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM
(degrees C)										
t estimates at each time. Linear interpolation is used to estimate values between the hourly inputs.)										
15.89	15.23	15.00	15.22	15.87	16.91	18.27	19.85	21.55	23.25	24.84
15.89	15.23	15.00	15.22	15.87	16.91	18.27	19.85	21.55	23.25	24.84

2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM	10:00 PM	11:00 PM
26.21	27.26	27.92	28.15	27.93	27.28	26.24	24.89	23.31	21.61
26.21	27.26	27.92	28.15	27.93	27.28	26.24	24.89	23.31	21.61

QUAL2Kw

Stream Water Quality Model

Bayou Avoca (9/26/2006)

Dew Point Temperature Data:

				Upstream	Downstream	12:00 AM	1:00 AM	2:00 AM
Upstream	Reach	Downstream	Reach	Distance	Distance	Hourly dewpoint temperature for eac		
Label	Label	Label	Number	km	km	(The input values are applied as poin		
Headwater	Bayou Avoca 1		1	23.00	22.90	23.88	22.30	20.93
	Bayou Avoca 2		2	22.90	0.00	23.88	22.30	20.93

3:00 AM	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM
h reach (degrees C)										
t estimates at each time. Linear interpolation is used to estimate values between the hourly inputs.)										
19.89	19.23	19.00	19.22	19.87	20.91	22.27	23.85	25.55	27.25	28.84
19.89	19.23	19.00	19.22	19.87	20.91	22.27	23.85	25.55	27.25	28.84

2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM	10:00 PM	11:00 PM
30.21	31.26	31.92	32.15	31.93	31.28	30.24	28.89	27.31	25.61
30.21	31.26	31.92	32.15	31.93	31.28	30.24	28.89	27.31	25.61

QUAL2Kw

Stream Water Quality Model

Bayou Avoca (9/26/2006)

Wind Speed Data:

				Upstream	Downstream	12:00 AM	1:00 AM	2:00 AM
Upstream	Reach	Downstream	Reach	Distance	Distance	Wind speed for each reach 7m above		
Label	Label	Label	Number	km	km	(The input values are applied as poin		
Headwater	Bayou Avoca 1		1	23.00	22.90	2.02	2.02	2.02
	Bayou Avoca 2		2	22.90	0.00	2.02	2.02	2.02

3:00 AM	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM
water surface (m/s)										
t estimates at each time. Linear interpolation is used to estimate values between the hourly inputs.)										
2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02
2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02

2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM	10:00 PM	11:00 PM
2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02
2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02

QUAL2Kw

Stream Water Quality Model

Bayou Avoca (9/26/2006)

Cloud Cover Data:

				Upstream	Downstream	12:00 AM	1:00 AM	2:00 AM	3:00 AM	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM
Upstream	Reach	Downstream	Reach	Distance	Distance	Hourly cloud cover shade for each reach (Percent)													
Label	Label	Label	Number	km	km	(Percent of sky that is covered by clouds. The input values are applied as point estimates at each time. Linear interpolation is used to estimate values between the hourly inputs.)													
Headwater	Bayou Avoca 1		1	23.00	22.90	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
	Bayou Avoca 2		2	22.90	0.00	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%

2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM	10:00 PM	11:00 PM
3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%

QUAL2Kw

Stream Water Quality Model

Bayou Avoca (9/26/2006)

Light Parameters and Surface Heat Transfer Models:

Parameter	*Value*	*Unit*	
Photosynthetically Available Radiation	**0.47**		
Background light extinction	**0.2**	*/m*	k_{eb}
Linear chlorophyll light extinction	**0.0088**	*1/m-(ugA/L)*	α_p
Nonlinear chlorophyll light extinction	**0.054**	*1/m-(ugA/L)$^{2/3}$*	α_{pn}
ISS light extinction	**0.052**	*1/m-(mgD/L)*	α_i
Detritus light extinction	**0.174**	*1/m-(mgD/L)*	α_o
Macrophyte light extinction	**0**	*1/m-(gD/m^3)*	α_{mac}
Solar shortwave radiation model			
Atmospheric attenuation model for solar	**Bras**		
Bras solar parameter (used if Bras solar model is selected)			
atmospheric turbidity coefficient (2=clear, 5=smoggy, default=2)	**4**		n_{fac}
Ryan-Stolzenbach solar parameter (used if Ryan-Stolzenbach solar model is selected)			
atmospheric transmission coefficient (0.70-0.91, default 0.8)	**0.8**		a_{tc}
Downwelling atmospheric longwave IR radiation			
atmospheric longwave emissivity model	**Koberg**		
Evaporation and air convection/conduction			
wind speed function for evaporation and air convection/conduction	**Adams 1**		

QUAL2Kw

Stream Water Quality Model

Bayou Avoca (9/26/2006)

Diffuse Source Data:

			Diffuse	Diffuse		Spec	Inorg	Diss	CBOD	CBOD
			Abstraction	Inflow	Temp	Cond	SS	Oxygen	slow	fast
Name	Up (km)	Down (km)	m3/s	m3/s	C	umhos	mgD/L	mg/L	mgO2/L	mgO2/L
	22.90	0.00		0.0037	27.53	565.00	24.38	6.62	0.00	0.00

Organic	Ammon	Nitrate	Organic	Inorganic	Phyto			Generic		
N	N	N	P	P	plankton	Detritus	Pathogen	constituent	Alk	pH
ugN/L	ugN/L	ugN/L	ugP/L	ugP/L	ug/L	mgD/L	cfu/100 mL	user defined	mgCaCO3/L	
650000.00	12.50	255.00	287500.00	18.33	40.00	25000.00	0.00		120.00	8.12

QUAL2Kw

Stream Water Quality Model

Bayou Avoca (9/26/2006)

Global rate parameters

Parameter	*Value*	*Units*	*Symbol*
Stoichiometry:			
Carbon	40	gC	gC
Nitrogen	7.2	gN	gN
Phosphorus	1	gP	gP
Dry weight	100	gD	gD
Chlorophyll	0.5	gA	gA
Inorganic suspended solids:			
Settling velocity	0	m/d	v_i
Oxygen:			
Reaeration model	Internal		
Temp correction	1.024		θ_a
Reaeration wind effect	Wanninkhof		
O2 for carbon oxidation	2.69	gO_2/gC	r_{oc}
O2 for NH4 nitrification	4.57	gO_2/gN	r_{on}
Oxygen inhib model CBOD oxidation	Exponential		
Oxygen inhib parameter CBOD oxidation	0.60	L/mgO2	K_{socf}
Oxygen inhib model nitrification	Exponential		
Oxygen inhib parameter nitrification	0.60	L/mgO2	K_{sona}
Oxygen enhance model denitrification	Exponential		
Oxygen enhance parameter denitrification	0.60	L/mgO2	K_{sodn}
Oxygen inhib model phyto resp	Exponential		
Oxygen inhib parameter phyto resp	0.60	L/mgO2	K_{sop}
Oxygen enhance model bot alg resp	Exponential		
Oxygen enhance parameter bot alg resp	0.60	L/mgO2	K_{sob}
Slow CBOD:			
Hydrolysis rate	0.6	/d	k_{hc}
Temp correction	1.047		θ_{hc}
Oxidation rate	0	/d	k_{dcs}
Temp correction	1.047		θ_{dcs}
Fast CBOD:			
Oxidation rate	0.9	/d	k_{dc}
Temp correction	1.047		θ_{dc}
Organic N:			
Hydrolysis	0.01	/d	k_{hn}
Temp correction	1.07		θ_{hn}
Settling velocity	0	m/d	v_{on}
Ammonium:			
Nitrification	2	/d	k_{na}
Temp correction	1.07		θ_{na}
Nitrate:			
Denitrification	0.06	/d	k_{dn}
Temp correction	1.07		θ_{dn}
Sed denitrification transfer coeff	0.03	m/d	v_{di}
Temp correction	1.07		θ_{di}

QUAL2Kw

Stream Water Quality Model

Bayou Avoca (9/26/2006)

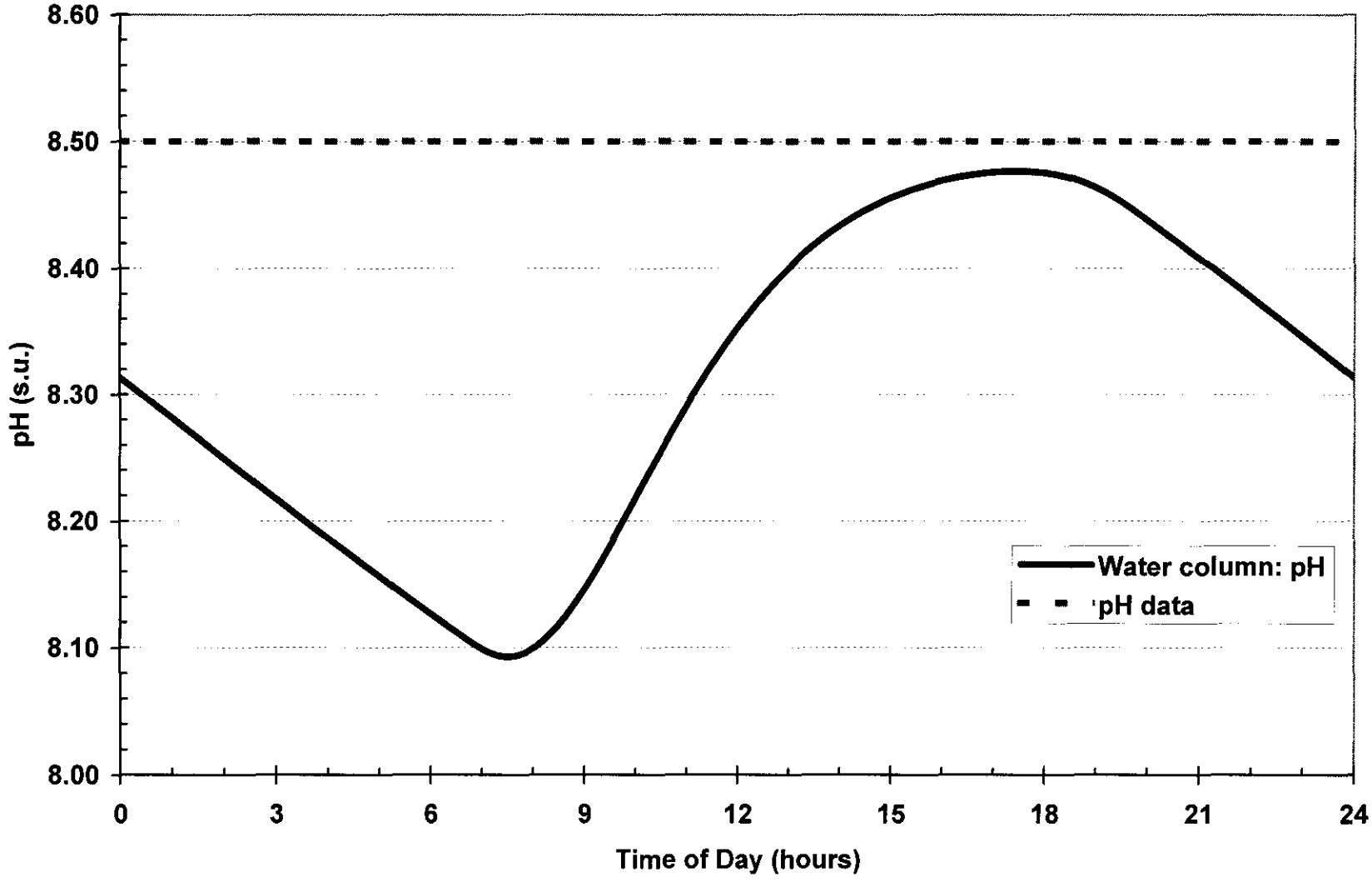
Global rate parameters

Organic P:			
Hydrolysis	0.06	/d	k_{hp}
Temp correction	1.07		θ_{hp}
Settling velocity	0	m/d	v_{op}
Inorganic P:			
Settling velocity	0	m/d	v_{ip}
Sed P oxygen attenuation half sat constant	1.7	mgO_2/L	k_{spi}
Phytoplankton:			
Max Growth rate	5	/d	k_{gp}
Temp correction	1.07		θ_{gp}
Respiration rate	0.1	/d	k_{rp}
Temp correction	1.07		θ_{rp}
Death rate	0	/d	k_{dp}
Temp correction	1.07		θ_{dp}
Nitrogen half sat constant	60	ugN/L	k_{sPp}
Phosphorus half sat constant	25	ugP/L	k_{sNp}
Inorganic carbon half sat constant	1.30E-05	moles/L	k_{sCp}
Phytoplankton use HCO3- as substrate	Yes		
Light model	Steele		
Light constant	200	langleys/d	K_{Lp}
Ammonia preference	25	ugN/L	k_{hnxp}
Settling velocity	0.55	m/d	v_a
Detritus (POM):			
Dissolution rate	0.003	/d	k_{dt}
Temp correction	1.07		θ_{dt}
Settling velocity	0	m/d	v_{dt}
pH:			
Partial pressure of carbon dioxide	375	ppm	p_{CO2}

APPENDIX H

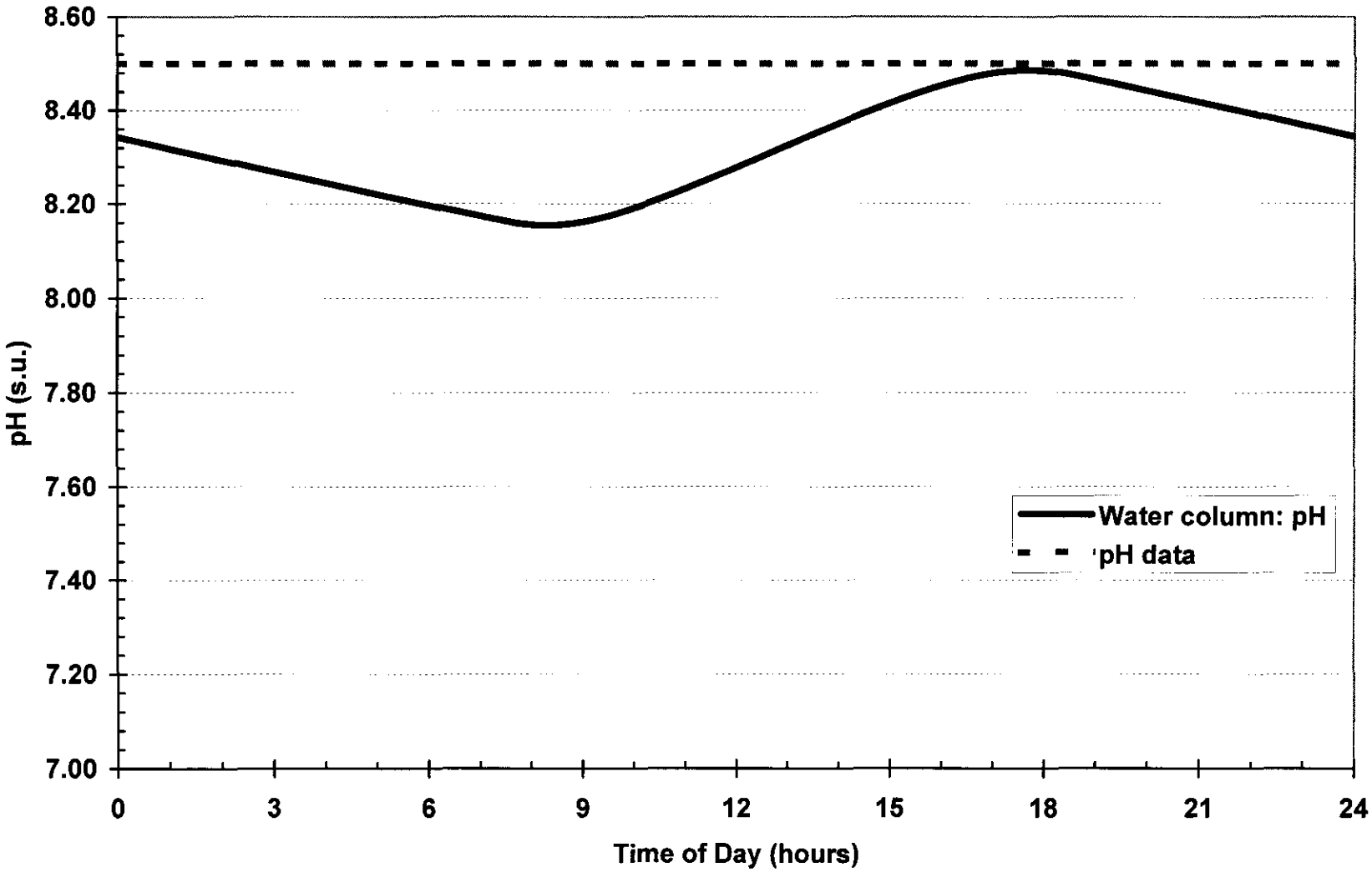
Outputs from Projection Models to Achieve pH Water Quality Criteria

Figure H.1. July pH projection for Lake Palourde.



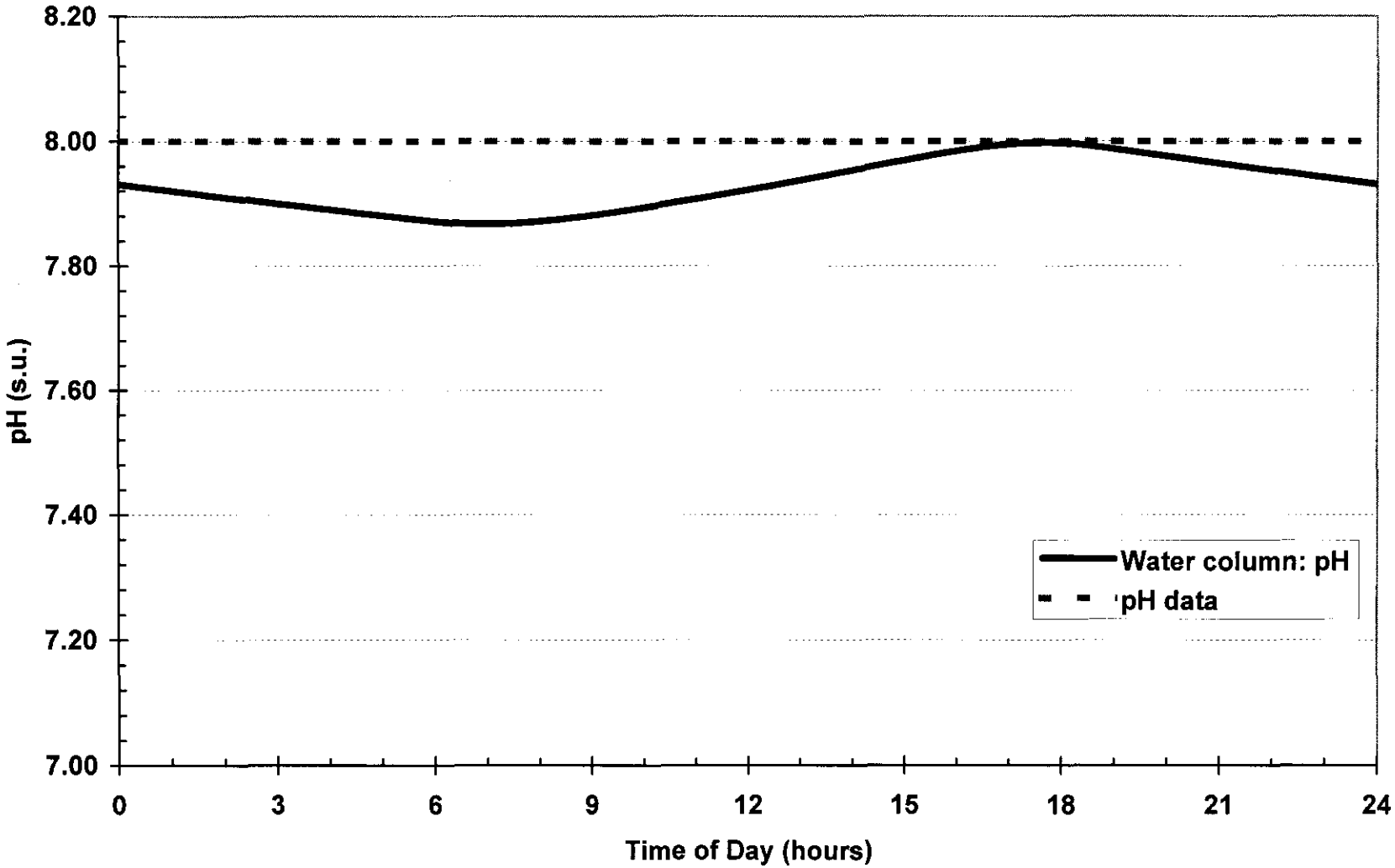
Palourde-July-proj.xls\pH Diel, 5/2/2007

Figure H.2. September pH projection for Lake Palourde.



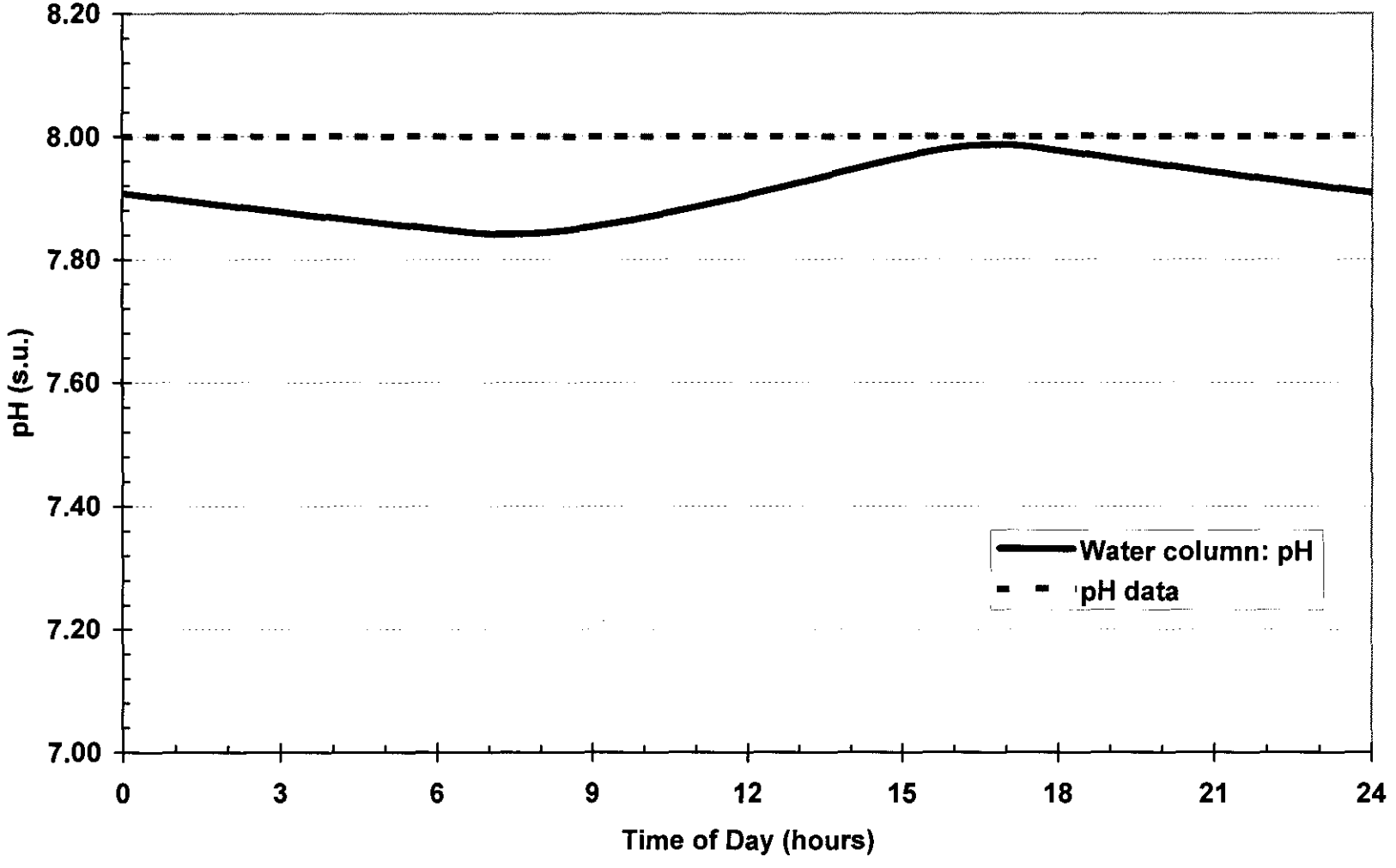
Palourde-Sept-proj.xls\pH Diel, 5/3/2007

Figure H.3. July pH projection for Bayou Avoca.



Avoca-July proj.xls\pH Diel, 5/2/2007

Figure H.4. September pH projection for Bayou Avoca.



Avoca-Sept proj.xls\pH Diel, 5/2/2007

APPENDIX I

TMDL Calculations

Lake Palourde

Model sources

	Headwater	Diffuse	Point Source	Total
Flow, cms	83.818	0.0043	0.372	
organic P, ug/L	162.64	0	200.00	
inorganic P, ug/L	81.36	0	100.00	
load, kg/day	1767.02	0.00	9.64	**1776.66**

	Headwater	Diffuse	Point Source	Total
Flow, cms	83.818	0.0043	0.372	
organic N, ug/L	1271.20	0	1916.00	
NH4 N, ug/L	40.00	0	60.00	
NO3 N, ug/L	16.00	0	24.00	
Load, kg/day	9611.42	0.00	64.28	**9675.70**

WLA

	Flow, gpd	Total P, mg/L	P WLA	Total N, mg/L	N WLA
Greenleaf Park Subdivision	25,000	1.88	0.18	11.22	1.06
Wildwood Subdivision	25,000	1.88	0.18	11.22	1.06
Morgan City MS4	8,490,703	0.30	9.64	2.00	64.24
Donner Community Center	5,000	1.88	0.04	11.22	0.21
Siracusa Subdivision	100,000	1.88	0.71	11.22	4.24
Amelia Oxidation Pond	65,000	1.88	0.46	11.22	2.76
Bayouside Trailer Park	25,000	1.88	0.18	11.22	1.06
Bayouside MHP	50,000	1.88	0.36	11.22	2.12
Total			11.73		76.76

Nutrient	**Phosphorus**	**Nitrogen**
TMDL	**1,777**	**9,676**
MOS	**178**	**968**
FG	**178**	**968**
WLA	**12**	**77**
LA	**1,410**	**7,664**

Bayou Avoca
Model sources

	Headwater	Diffuse	Point Source	Total
Flow, cms	5.012	0.006	0	
organic P, ug/L	96.70	172500.00	0.00	
inorganic P, ug/L	48.30	7.25	0.00	
load, kg/day	62.79	82.76	0.00	**145.55**

	Headwater	Diffuse	Point Source	Total
Flow, cms	5.012	0.006	0	
organic N, ug/L	1413.00	390000.00	0.00	
NH4 N, ug/L	50.00	7.50	0.00	
NO3 N, ug/L	1215.00	182.25	0.00	
Load, kg/day	1159.67	187.20	0.00	**1346.88**

Nutrient	**Phosphorus**	**Nitrogen**
TMDL	**146**	**1,347**
MOS	**15**	**135**
FG	**15**	**135**
WLA	**0**	**0**
LA	**116**	**1,078**