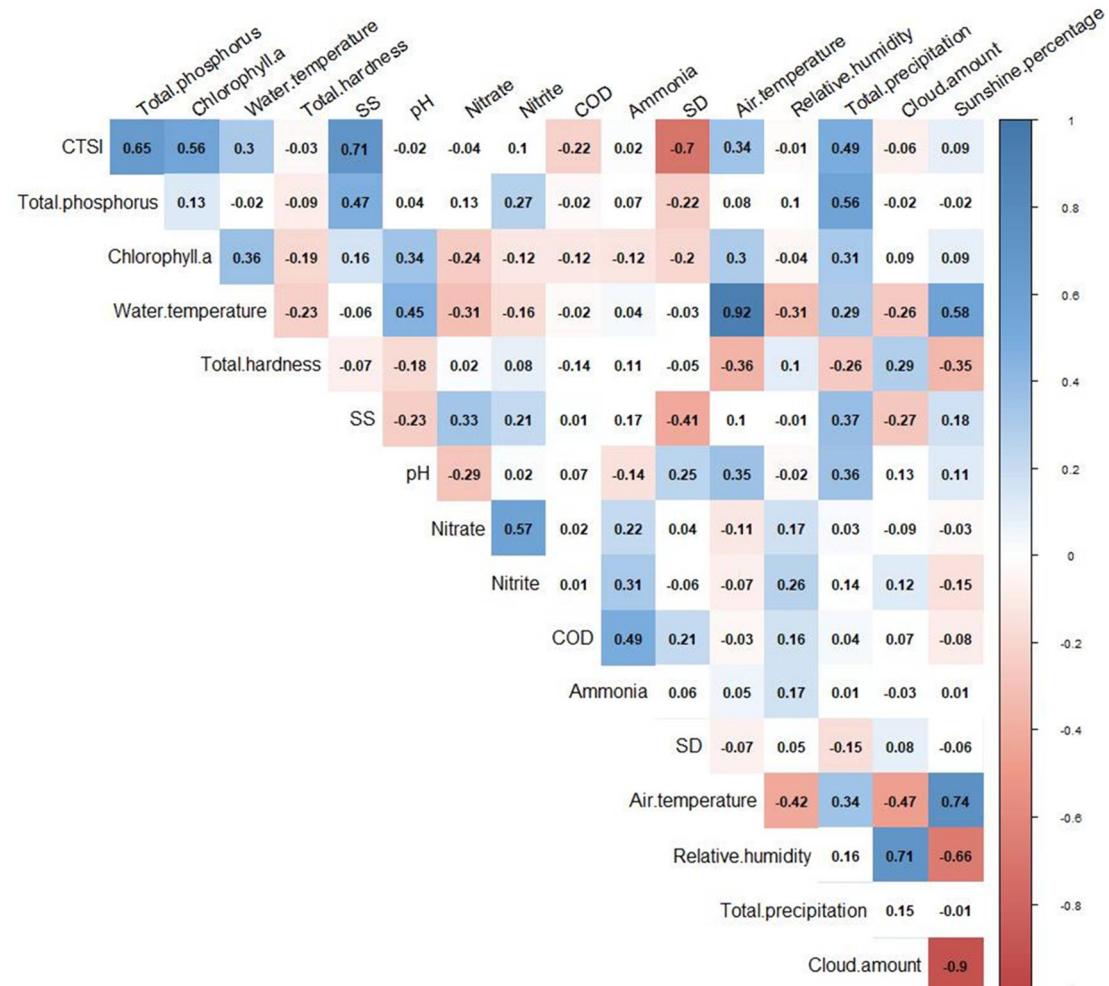
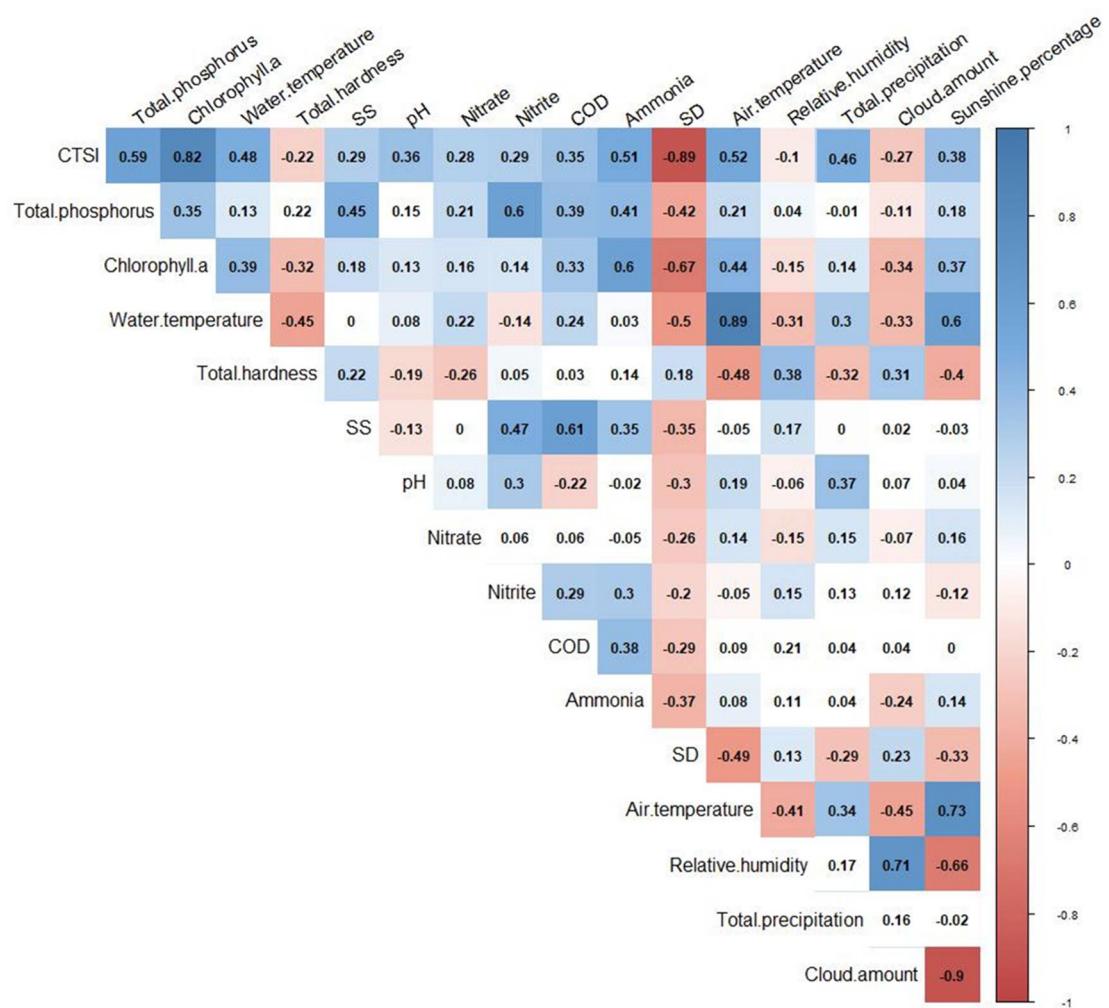


Supplementary Figure 1. Pearson's correlation plots among water quality and weather factors in (a) Shihmen Reservoir, (b) Liyutan Reservoir, (c) Wushantou Reservoir and (d) Chengchinghu Reservoir.

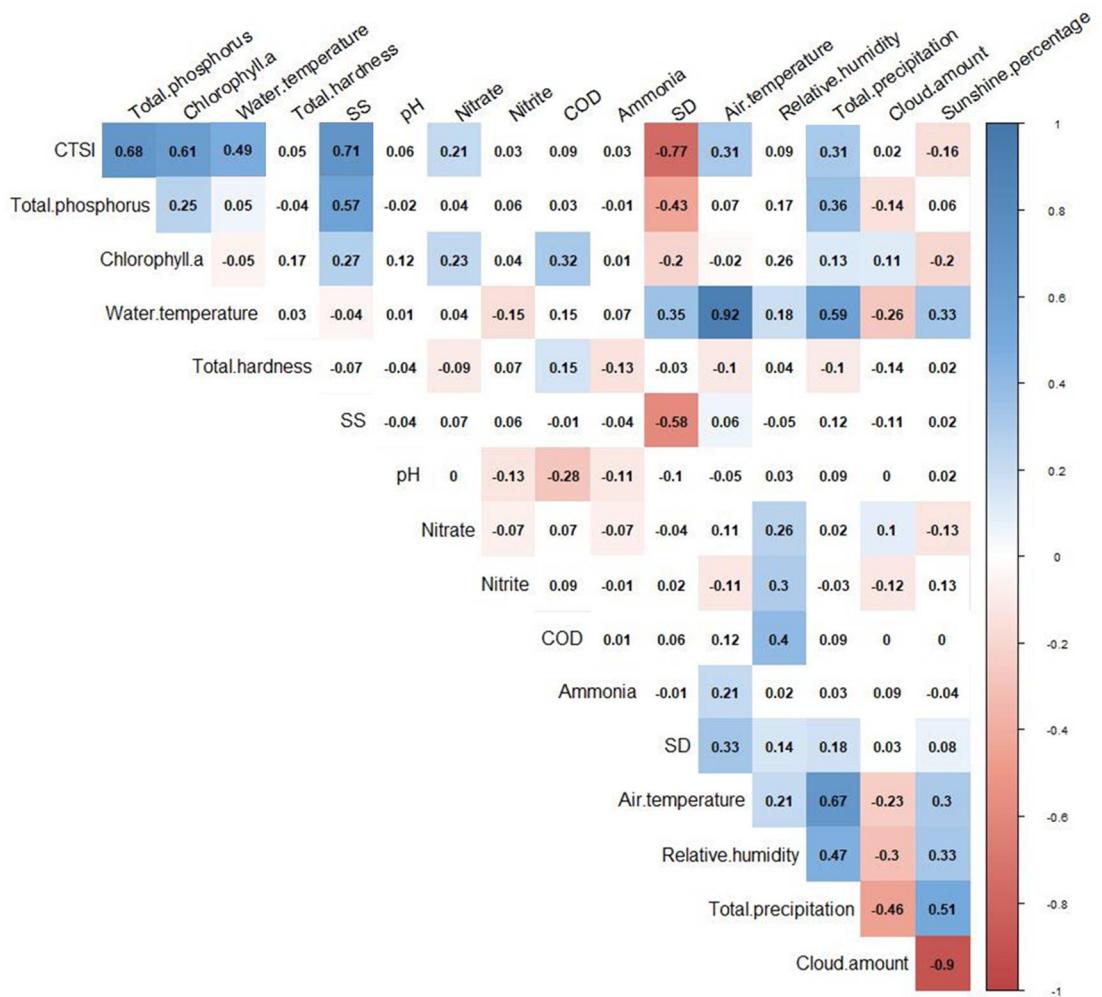


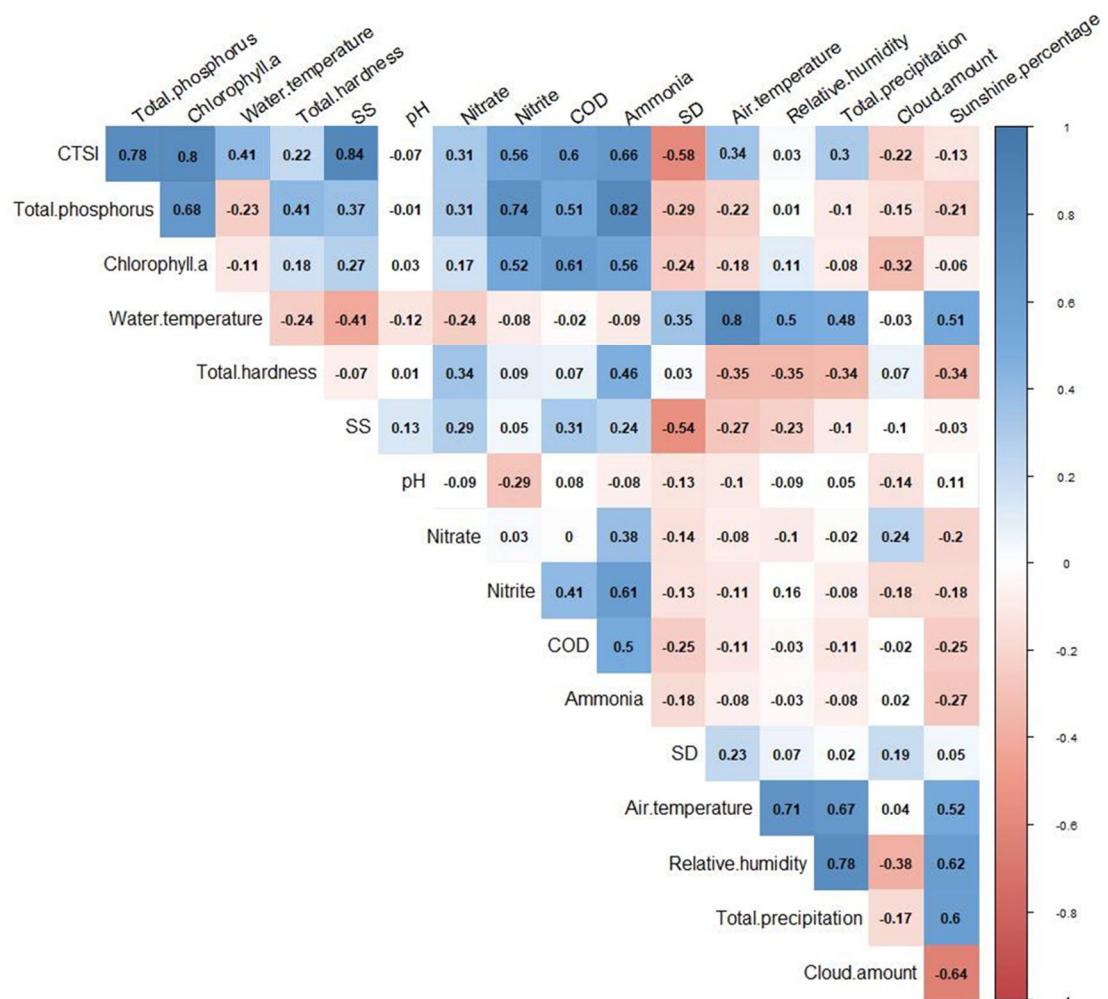
(a)



(b)

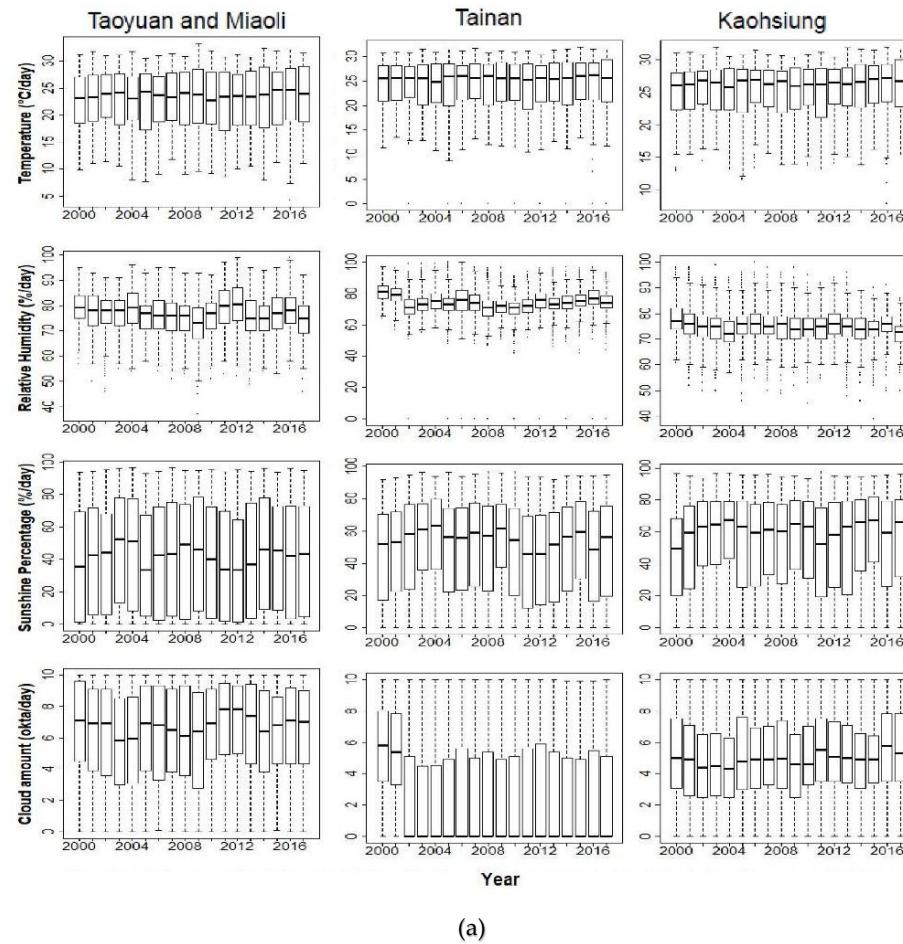
(c)



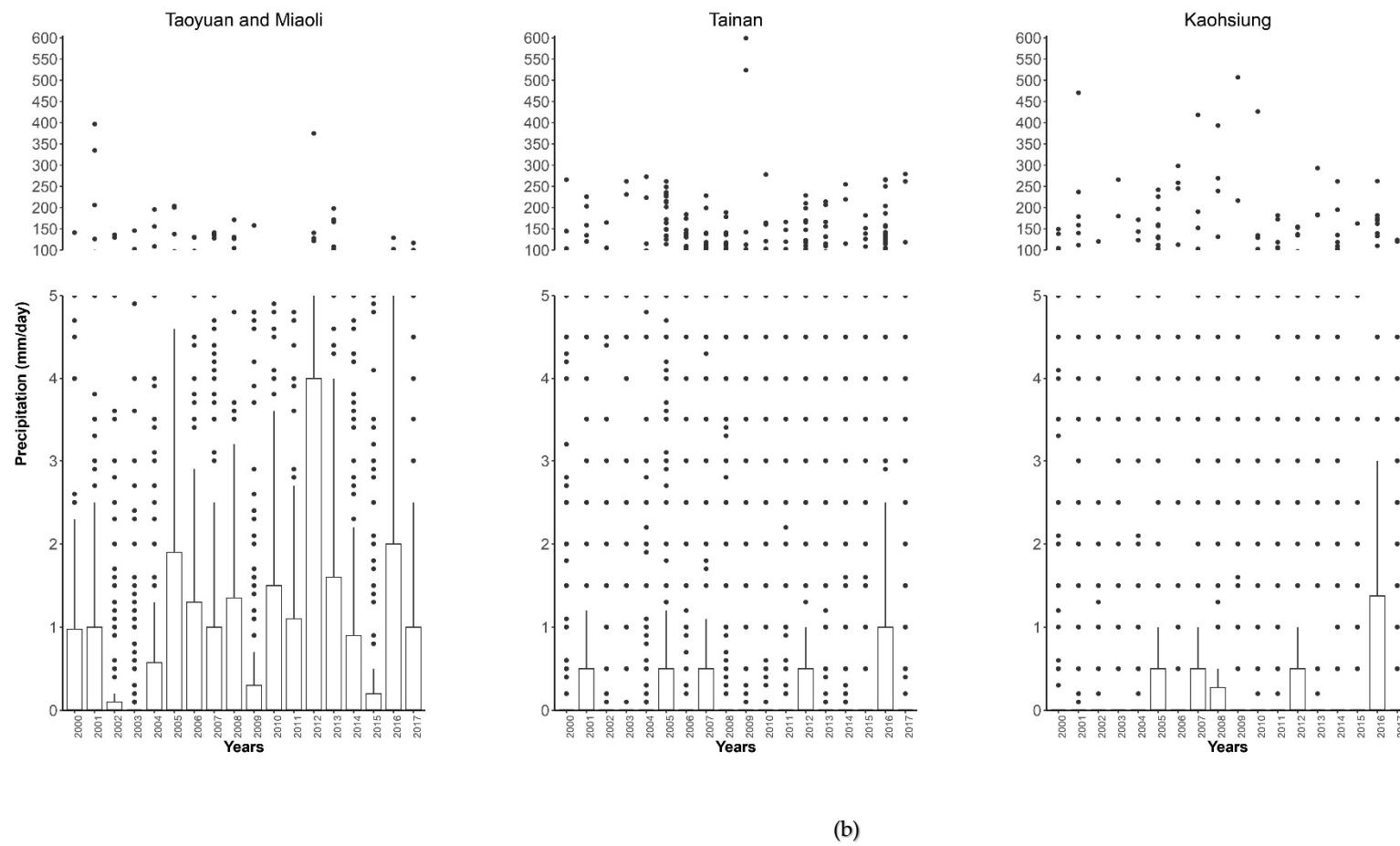


(d)

Supplementary Figure S2. Boxplots of daily weather parameters in study area from 2000 to 2017 (a) temperature, relative humidity, sunshine percentage, cloud amount and (b) precipitation



(a)



Supplementary Table S1. Reservoirs characteristic

Reservoir Name	Coordinate	Location	Function	Type	Watershed	Height (m)	Length (m)	Catchment Area (km ²)	Effective Storage Capacity (m ³)
Shihmen Reservoir	24°48'38"N, 121°14'39"E	Taoyuan City	Domestic, agricultural and industrial developments in northern Taiwan and prevents calamities such as floods and droughts	Embankment	Dahan River	133.1	360	763	202.56 x 10 ⁶
Liyutan Reservoir	24°20'28.59"N, 120°46'53.9"E	Miaoli County	Public water supply and industrial water for Miaoli County and Dataizhong area	Embankment	Daan River	96	235	53.45	115.47 x 10 ⁶
Wushantou Reservoir	23°12'08"N, 120°22'06"E	Tainan City	Public water supply, industry, and irrigation system in Tainan City	Embankment	Zengwen River	56	1273	58	168.25 x 10 ⁶
Chengchin ghu Reservoir	22°39'39.0"N, 120°21'08.1"E	Kaohsiung City	Industrial use and supplies high-quality water for people's livelihood in the Kaohsiung City	Embankment	Caogong River	19	600	2.8	109.17 x 10 ⁶

Source: Taiwan Water Resource Agency

Supplementary Table S2. Water quality measurement methods

Water Quality Parameters	Unit	Test Method by National Institute of Environmental Analysis (NIEA)	Measurement Methods
Water temperature	°C	NIEA W217.51A	Thermometer
potential Hydrogen (pH)	-	NIEA W424.52A	Electrode method
Suspended Solid (SS)	mg/L	NIEA W210.58A	Drying at 103°C – 105°C
Chemical Oxygen Demand (COD)	mg/L	NIEA W516.55A	Potassium dichromate method with halide ions of high concentration
Ammonia	mg/L	NIEA W437.52C	Indophenol method
Nitrite	mg/L	NIEA W418.53C	Spectrophotometer method
Nitrate	mg/L	NIEA W415.53B	Ion chromatographic method
Total Phosphorus (TP)	mg/L	NIEA W427.53B	Spectrophotometer method / Vitamin C method
Total hardness	mg/L as CaCO ₃	No information	No information
Chlorophyll-a (Chl-a)	µg/L	No information	No information
Secchi depth (SD)	meter		Secchi disk

Source: Taiwan Environmental Protection Administration (<https://wq.epa.gov.tw>)

Supplementary Table S3. Descriptive statistic of water quality in (a) Shihmen, (b) Liyutan, (c) Chengchinghu, and (d) Wushantou

(a)

Water Quality Parameters	Descriptive Statistic	Fall	Spring	Summer	Winter
CTSI observation data	Min	39.40	33.00	37.00	39.40
	Mean	50.40	50.80	50.61	46.92
	Max	67.00	67.00	65.90	61.00
	Standard Deviation	5.09	6.18	5.53	3.70
Total phosphorus (mg/L)	Min	0.01	0.01	0.01	0.00
	Mean	0.03	0.03	0.03	0.02
	Max	0.38	0.08	0.08	0.09
	Standard Deviation	0.03	0.02	0.01	0.01
Chlorophyll-a ($\mu\text{g/L}$)	Min	0.10	0.20	0.20	0.33
	Mean	4.48	5.32	6.28	2.92
	Max	33.60	28.20	56.80	9.40
	Standard Deviation	4.35	4.54	6.53	1.55
Water temperature ($^{\circ}\text{C}$)	Min	14.60	12.60	12.30	8.80
	Mean	22.23	21.77	26.83	16.19
	Max	29.60	27.30	30.80	20.50
	Standard Deviation	2.71	3.18	3.46	1.64
Total hardness (mg/L as CaCO_3)	Min	19.40	77.30	62.00	46.50
	Mean	82.73	102.37	85.99	102.23
	Max	110.00	143.00	118.00	127.00
	Standard Deviation	15.81	14.65	12.27	12.24
SS (mg/L)	Min	0.70	0.70	0.40	0.80
	Mean	18.67	8.65	9.33	5.85
	Max	1650.00	137.00	92.60	102.00
	Standard Deviation	119.45	14.56	16.06	10.60
pH	Min	7.10	6.90	6.82	7.00
	Mean	8.11	8.28	8.44	8.02
	Max	9.10	9.30	9.30	9.54
	Standard Deviation	0.38	0.53	0.57	0.42
Nitrate (mg/L)	Min	0.06	0.08	0.01	0.14
	Mean	0.33	0.27	0.30	0.35
	Max	0.69	0.55	0.85	1.91
	Standard Deviation	0.13	0.10	0.18	0.20
Nitrite (mg/L)	Min	0.001	0.001	0.001	0.001
	Mean	0.01	0.01	0.01	0.01
	Max	0.02	0.03	0.02	0.12
	Standard Deviation	0.004	0.005	0.004	0.013
COD (mg/L)	Min	4.00	4.00	4.00	1.39
	Mean	7.90	9.61	7.17	8.37
	Max	36.50	56.59	24.92	30.60
	Standard Deviation	5.65	10.18	2.95	6.19
Ammonia (mg/L)	Min	0.01	0.01	0.01	0.01
	Mean	0.05	0.06	0.05	0.04
	Max	0.23	0.35	0.16	0.16

Water Quality Parameters		Descriptive Statistic	Fall	Spring	Summer	Winter
SD (meter)	Standard Deviation	0.04	0.08	0.03	0.04	
	Min	0.20	0.20	0.10	0.30	
	Mean	1.54	1.57	1.87	1.93	
	Max	3.60	3.50	3.80	3.80	
	Standard Deviation	0.80	0.86	0.87	0.78	

(b)

Water Quality Parameters		Descriptive Statistic	Fall	Spring	Summer	Winter
CTSI observation data	Min	36.40	36.60	38.10	30.30	
	Mean	48.12	46.23	51.76	41.75	
	Max	63.50	57.00	64.70	58.30	
	Standard Deviation	5.81	4.58	6.68	5.32	
	Min	0.00	0.00	0.01	0.00	
Total phosphorus (mg/L)	Mean	0.02	0.01	0.02	0.02	
	Max	0.06	0.08	0.06	0.10	
	Standard Deviation	0.01	0.01	0.01	0.02	
	Min	0.20	0.10	0.30	0.10	
	Mean	8.09	4.95	8.96	2.67	
Chlorophyll-a (µg/L)	Max	58.80	33.80	47.40	9.60	
	Standard Deviation	10.40	6.68	10.80	1.86	
	Min	17.40	16.00	17.90	12.20	
	Mean	23.34	22.17	25.69	18.32	
	Max	29.80	29.10	32.70	22.20	
Water temperature (°C)	Standard Deviation	2.87	3.96	4.50	1.78	
	Min	114.00	128.00	104.00	146.00	
	Mean	153.89	166.09	143.48	167.47	
	Max	198.00	384.00	187.00	187.00	
	Standard Deviation	21.87	28.46	24.24	10.84	
Total hardness (mg/L as CaCO ₃)	Min	1.10	1.00	1.10	0.70	
	Mean	4.01	4.18	4.48	4.60	
	Max	13.40	50.25	12.90	41.70	
	Standard Deviation	2.48	5.03	2.74	5.24	
	Min	6.50	7.20	6.90	7.40	
SS (mg/L)	Mean	8.09	8.19	8.28	8.08	
	Max	9.20	9.10	9.60	9.53	
	Standard Deviation	0.60	0.56	0.76	0.34	
	Min	0.01	0.01	0.01	0.14	
	Mean	0.55	0.42	0.69	0.50	
Nitrate (mg/L)	Max	1.75	1.28	5.30	1.26	
	Standard Deviation	0.39	0.28	0.71	0.23	
	Min	0.00	0.00	0.00	0.00	
	Mean	0.01	0.01	0.02	0.01	
	Max	0.03	0.13	0.09	0.23	
Nitrite (mg/L)	Standard Deviation	0.01	0.02	0.02	0.03	
	Min	4.20	4.00	4.00	4.00	
COD	Min	4.20	4.00	4.00	4.00	

(mg/L)	Mean	8.82	9.95	11.00	8.07
	Max	34.30	48.82	37.17	22.39
	Standard Deviation	5.77	8.47	7.16	4.08
	Min	0.02	0.07	0.00	0.07
Ammonia (mg/L)	Mean	0.37	0.27	0.40	0.29
	Max	1.20	0.74	1.30	0.88
	Standard Deviation	0.23	0.14	0.31	0.17
	Min	0.60	0.80	0.40	1.50
SD (meter)	Mean	1.91	2.02	1.58	3.03
	Max	4.10	3.50	4.50	5.50
	Standard Deviation	0.82	0.65	0.99	0.88

(c)

Water Quality Parameters	Descriptive Statistic	Fall	Spring	Summer	Winter
CTSI observation data	Min	44.79	46.13	46.03	48.43
	Mean	54.13	55.08	54.01	57.74
	Max	68.20	68.63	65.13	70.58
	Standard Deviation	6.27	7.13	5.97	7.16
Total phosphorus (mg/L)	Min	0.01	0.01	0.01	0.02
	Mean	0.05	0.05	0.04	0.07
	Max	0.22	0.14	0.09	0.25
	Standard Deviation	0.05	0.04	0.03	0.07
Chlorophyll-a (µg/L)	Min	2.34	1.22	3.19	0.25
	Mean	7.78	12.51	9.10	13.28
	Max	25.36	44.63	33.60	46.33
	Standard Deviation	6.88	13.41	9.26	13.07
Water temperature (°C)	Min	23.86	28.24	28.20	18.26
	Mean	27.29	30.03	30.44	21.37
	Max	29.90	32.30	31.82	24.02
	Standard Deviation	1.71	1.11	1.23	1.46
Total hardness (mg/L as CaCO ₃)	Min	195.80	179.12	101.16	230.40
	Mean	249.38	220.72	160.26	253.68
	Max	541.80	248.00	202.60	283.14
	Standard Deviation	93.42	22.94	34.06	14.73
SS (mg/L)	Min	6.25	4.10	6.86	7.30
	Mean	11.13	11.44	10.96	15.47
	Max	24.04	21.62	31.62	32.08
	Standard Deviation	4.47	5.31	6.05	6.78
pH	Min	7.55	7.33	7.78	7.49
	Mean	8.05	8.04	8.07	8.13
	Max	8.35	8.62	8.32	8.35
	Standard Deviation	0.21	0.32	0.16	0.22
Nitrate (mg/L)	Min	0.21	0.13	0.32	0.48
	Mean	0.78	0.46	0.66	0.81
	Max	1.44	0.87	1.44	1.32
	Standard Deviation	0.37	0.23	0.33	0.27
Nitrite	Min	0.008	0.008	0.012	0.012

Water Quality Parameters	Descriptive Statistic	Fall	Spring	Summer	Winter
(mg/L)	Mean	0.03	0.04	0.03	0.05
	Max	0.10	0.20	0.12	0.19
	Standard Deviation	0.03	0.05	0.03	0.06
	Min	4.00	4.04	4.00	4.00
COD (mg/L)	Mean	6.15	9.60	6.60	8.09
	Max	17.02	29.75	18.35	25.47
	Standard Deviation	3.51	7.70	3.94	5.69
	Min	0.01	0.01	0.01	0.01
Ammonia (mg/L)	Mean	0.09	0.08	0.05	0.09
	Max	0.58	0.44	0.29	0.49
	Standard Deviation	0.15	0.12	0.07	0.13
	Min	0.65	0.59	0.35	0.38
SD (meter)	Mean	0.98	1.07	1.03	0.83
	Max	1.68	1.65	1.78	1.43
	Standard Deviation	0.27	0.35	0.35	0.31

(d)

Water Quality Parameters	Descriptive statistic	Fall	Spring	Summer	Winter
CTSI observation data	Min	36	32	34.5	33.3
	Mean	44.83	41.82	45.04	47.29
	Max	55.3	54	60	57
	Standard Deviation	4.07	4.68	4.74	4.62
Total phosphorus (mg/L)	Min	0.01	0	0.01	0.01
	Mean	0.02	0.02	0.02	0.02
	Max	0.07	0.09	0.14	0.06
	Standard Deviation	0.01	0.01	0.02	0.01
Chlorophyll-a (µg/L)	Min	0.1	0.1	0.1	0.1
	Mean	2.31	1.25	2.3	2.19
	Max	7.7	3.3	10.96	8.7
	Standard Deviation	1.59	0.66	1.7	1.42
Water temperature (°C)	Min	22	20.3	22.3	8.2
	Mean	26.38	26.7	29.04	20.08
	Max	32	30.9	32.6	23.7
	Standard Deviation	1.93	2.56	2.3	1.66
Total hardness (mg/L as CaCO ₃)	Min	82.7	84.1	91.8	90.9
	Mean	116.98	124.9	118.6	122.25
	Max	162	158	154	150
	Standard Deviation	16.77	17.3	13.8	18.15
SS (mg/L)	Min	1	1.1	1.5	2.3
	Mean	8.24	6.54	8.55	8
	Max	96	73	60.8	53.2
	Standard Deviation	11.28	7.96	9.51	5.82
pH	Min	7.2	7.1	6.5	6.72
	Mean	8.16	8.19	8.11	8.17
	Max	9.1	8.6	8.9	8.9

Water Quality Parameters	Descriptive statistic	Fall	Spring	Summer	Winter
Nitrate (mg/L)	Standard Deviation	0.36	0.31	0.51	0.27
	Min	0.02	0.01	0.06	0.1
	Mean	0.6	0.28	0.6	0.52
	Max	1.41	0.65	1.53	0.96
Nitrite (mg/L)	Standard Deviation	0.28	0.15	0.33	0.19
	Min	0.001	0.001	0.001	0.001
	Mean	0.005	0.004	0.008	0.006
	Max	0.02	0.02	0.03	0.08
COD (mg/L)	Standard Deviation	0.003	0.003	0.005	0.009
	Min	4.1	4	4	2.81
	Mean	8.05	6.24	8.56	7.72
	Max	41.6	20.6	43.76	34.11
Ammonia (mg/L)	Standard Deviation	5.76	2.62	6.24	7
	Min	0.01	0.01	0.01	0.01
	Mean	0.13	0.04	0.08	0.03
	Max	1.38	0.18	0.86	0.23
SD (meter)	Standard Deviation	0.26	0.03	0.14	0.03
	Min	0.4	0.6	0.4	0.3
	Mean	1.7	1.89	1.77	1.24
	Max	3.4	3.4	3.3	2.9
Standard Deviation		0.59	0.6	0.64	0.59