Supplementary Materials

Fecal contamination and high nutrient levels pollute the watersheds of Wujiang, China

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Supplementary Tables

Table S1. Sampling locations in the rivers and the lake, including the geographic coordinates (GPS coordinates).

Sampling locations	Name of River or lake	GPS Latitude	GPS Longitude
1	LiPuDang Lake (LPD)	120.73417313	31.05613997
2		120.73087603	31.05705390
3		120.72847411	31.05540297
4		120.73096052	31.05428854
5		120.73279783	31.05312585
6	XiDaGang River (XDG)	120.69197327	30.98629904
7		120.69869086	30.98628640
8		120.70044503	30.98349714
9		120.69903485	30.97990928
10		120.70080444	30.97521169
11	WuFangGang Canal (WFG)	120.65343898	31.10217826
12		120.65683197	31.10219319
13		120.66093910	31.10204276
14		120.66782903	31.10019912
15		120.67236196	31.10188257
16	DaDeTang River (DDT)	120.53484946	30.83408890
17		120.52471474	30.83958967
18		120.51656149	30.85120798
19		120.50946102	30.86883742
20		120.49954087	30.88098221
21	ZiXingTang River	120.51865362	30.83171265

22	(ZXT)	120.51287010	30.81488494
23		120.51177576	30.79952823
24		120.50508834	30.78540934
25		120.50349444	30.76295689
C1	Taihu Lake Source Protection Area (TH/Control)	120.47414303	31.19184156
C2		120.46513081	31.18949200
C3		120.46933651	31.18780322

Table S2. The methods used for measuring or testing the physicochemical parameters.

Parameters tested	**Testing Methods (Chinese national standards)**
Water and air temperatures	Thermometer
pH	Portable pH meter
DO	Electrochemical probe method (HJ 506-2009)
$KMnO_4$ index	Acidic permanganate method (GB/T 11892-1989)
TP	Ammonium molybdate spectrophotometry (GB/T 11893-1989)
PO_4-P	Alkali fusion-Mo-Sb Anti spectrophotometric method (HJ632-2011)
TN	Alkaline potassium persulfate digestion UV spectrophotometry (HJ 636-2012)
NH_4-N	Nessler's reagent spectrophotometry HJ 535-2009
NO_2-N	Spectrophotometry GB/T 7493-1987
NO_3-N	Spectrophotometry（in trials） HJ/T 346-2007
TOC	Combustion oxidation nondispersive infrared absorption method HJ 501-2009
COD	Dichromate method HJ 828-2017
BOD	Determination of biochemical oxygen demand after 5 days (BOD5) HJ 505-2009

Table S3. Physicochemical and microbiological characteristics of LiPuDang (LPD) with statistical analyses.

	August		September		October		Guideline value (MEP Surface Water class III)	P-Value(difference between months)	P-Value(difference between samples)
	Range	Mean±SD	Range	Mean±SD	Range	Mean±SD			
AT (℃)	30-33.9	31.4±1.6	27.2-30	28.4±1.0	21.8-24.4	22.8±1.0	-	4.79e-07 ***	0.968
WT (℃)	31-32.6	31.6±0.6	25.6-26.6	26.1±0.4	21.5-22	21.7±0.2	-	9.65e-13 ***	0.981
pH	8.14-8.88	8.40±0.32	8.1-8.94	8.5±0.3	8.11-8.29	8.23±0.07	6~9	0.304	0.0933
EC	371-400	391±12	420-429	423.6±3.4	417-424	420±3	-	2e-05 ***	0.638
DO (mg/L)	6.74-8.92	7.62±0.91	**4.19**-6.84	6.0±1.1	6.40-7.25	6.87±0.37	≥5mg/L	0.028 *	0.825
BOD_5 (mg/L)	**5.4-7.3**	**6.1±0.8**	1.9-**27.2**	**7.3±11.1**	1.6-2	1.8±0.2	≤4mg/L	0.397	0.435
COD (mg/L)	**51-86**	**68±14**	**25-139**	**52±49**	18-**22**	20±2	≤20mg/L	0.0695	0.274
KMnO4 (mg/L)	**6.2-8**	**7.1±0.6**	**6.8-7.8**	**7.2±0.4**	5.5-**6.9**	6.0±0.5	≤6mg/L	0.00928 **	0.568
TN (mg/L)	**2.01-3.56**	**2.52±0.62**	**1.78-5.42**	**2.7±1.5**	**1.58-2.59**	**2.18±0.48**	≤1mg/L	0.741	0.39
TP (mg/L)	**0.12-0.23**	**0.17±0.04**	0.02-0.04	0.03±0.01	**0.12-0.16**	**0.14±0.02**	≤0.2mg/L (≤0.05mg/L [a])	3.32e-06 ***	0.68
NO_3-N (mg/L)	0.25-0.66	0.54±0.17	0.94-1.48	1.24±0.23	0.32-0.59	0.44±0.12	≤10 mg/L	1.78e-05 ***	0.821
NO_2-N (mg/L)	0.005-0.08	0.035±0.029	0.043-0.083	0.055±0.016	0.064-0.077	0.071±0.005	≤0.15mg/L	0.0368 *	0.982
PO_4-P (mg/L)	**0.1-0.18**	**0.13±0.03**	ND-0.01	<0.01	**0.02-0.03**	**0.03±0.00**	<0.02 mg/L	5.53e-07 ***	0.707
NH_4-N (mg/L)	0.039-0.058	0.052±0.008	0.040-0.050	0.04±0.01	0.290-0.530	0.410±0.094	≤1mg/L	1.76e-07 ***	0.974
TOC (mg/L)	9.2-10.5	9.8±0.5	6.5-7	6.7±0.2	6.4-7.4	6.8±0.4	-	3.63e-08 ***	0.828
Chl *a* (ug/L)	122.5-166.1	142.8±19.5	174.9-502.2	334.7±134.5	103.9-124.3	111.29±8.30	-	0.00145 **	0.191
TC (Log cfu/mL)	2.48-3.36	3.09±2.85	1.48-2.98	2.39±2.60	2.52-2.87	2.70±2.21	-	0.000623 ***	0.225

FC (Log cfu/100mL）	2.40-**3.24**	**2.90±2.79**	2.40-**3.80**	**3.41±3.38**	2.35-**3.05**	**2.67±2.57**	≤3	0.0952	0.936

* Statistically significant difference at $p < 0.05$; ** Statistically significant difference at $p < 0.01$; *** Statistically significant difference at $p < 0.001$; MEP: Ministry of Environmental Protection, PR China. The values exceeded the MEP guideline values are indicated in bold.

Table S4. Physicochemical and microbiological characteristics of XiDaGang (XDG) with statistical analyses.

	August		September		October		Guideline value (MEP Surface Water class III)	P-Value(difference between months)	P-Value(difference between samples)
	Range	Mean±SD	Range	Mean±SD	Range	Mean±SD			
AT (℃)	32.8-33.7	33.4±0.4	25.6-26.4	26.2±0.3	22.1-23.6	23.0±0.6	-	4.06e-13 ***	0.954
WT (℃)	32.3-32.8	32.5±0.2	24.9-25.8	25.3±0.4	21.1-22.5	21.9±0.5	-	7.38e-14 ***	0.973
pH	8.14-8.24	8.19±0.04	7.7-7.77	7.74±0.03	7.79-7.94	7.85±0.06	6~9	4.31e-09 ***	0.823
EC	305-310	308±2	380-385	383±2	426-430	428±1	-	<2e-16 ***	1
DO (mg/L)	7.33-7.72	7.44±0.17	**4.07**-8.55	5.10±1.93	6.2-6.93	6.59±0.30	≥5mg/L	0.0207 *	0.939
BOD_5 (mg/L)	1.6-3.5	2.4±0.7	1.4-2.5	2.1±0.5	1.5-1.8	1.6±0.1	≤4mg/L	0.0904	0.0196*
COD (mg/L)	14-**49**	**31±14**	11-**31**	**21±9**	10-11	10±0	≤20mg/L	0.0165 *	0.103
KMnO4 (mg/L)	4.1-4.6	4.4±0.2	3.3-3.6	3.5±0.1	3.6-4.3	3.9±0.3	≤6mg/L	7.82e-05 ***	0.488
TN (mg/L)	0.92-**2.07**	**1.47±0.53**	**1.45-2.22**	**1.72±0.30**	**1.89-2.78**	**2.30±0.36**	≤1mg/L	0.0206 *	0.0135*
TP (mg/L)	0.07-0.18	0.11±0.05	0.08-0.14	0.10±0.02	0.08-0.1	0.09±0.01	≤0.2mg/L (≤0.05mg/L [a])	0.776	0.4
NO_3-N (mg/L)	0.24-0.37	0.31±0.05	0.58-1.34	0.80±0.32	0.19-0.41	0.29±0.09	≤10 mg/L	0.00179 **	0.305
NO_2-N (mg/L)	0.055-**0.200**	0.113±0.071	0.062-0.08	0.073±0.007	0.116-0.133	0.122±0.007	≤0.15mg/L	0.182	0.0809
PO_4-P (mg/L)	**0.06-0.15**	**0.09±0.04**	**0.07-0.09**	**0.08±0.01**	**0.07-0.09**	**0.08±0.01**	<0.02 mg/L	0.576	0.0501
NH_4-N (mg/L)	0.314-**1.430**	**0.901±0.476**	0.63-0.76	0.698±0.048	**1.47-1.77**	**1.618±0.107**	≤1mg/L	0.000615 ***	0.22
TOC (mg/L)	6.5-6.6	6.5±0.0	3.9-4	4.0±0.1	4-4.1	4.1±0.0	-	<2e-16 ***	0.989
Chl *a* (ug/L)	12.4-43.3	20.1±13.0	16.6-62.8	47.2±18.8	6.5-15.6	11.62±3.86	-	0.00321 **	0.665
TC (Log cfu/mL)	1.78-2.71	2.26±2.27	0.00-1.00	0.60±0.74	1.18-2.20	1.83±1.77	-	0.0978	0.0476*
FC (Log	2.40-**3.18**	**2.90±2.68**	**3.14-3.87**	**3.63±3.44**	2.88-**3.36**	**3.15±2.75**	≤3	0.00397**	0.482

cfu/100mL）									

* Statistically significant difference at $p < 0.05$; ** Statistically significant difference at $p < 0.01$; *** Statistically significant difference at $p < 0.001$; MEP: Ministry of Environmental Protection, PR China. The values exceeded the MEP guideline values are indicated in bold.

Table S5. Physicochemical and microbiological characteristics of WuFangGang (WFG) with statistical analyses.

	August		September		October		Guideline value (MEP Surface Water class III)	P-Value(difference between months)	P-Value(difference between samples)
	Range	Mean±SD	Range	Mean±SD	Range	Mean±SD			
AT (℃)	32.4-34.5	33.3±0.9	25.4-27.3	26.1±0.8	20.7-22.5	21.6±0.8	-	1.43e-10 ***	0.976
WT (℃)	33.1-33.4	33.3±0.1	24.4-25.7	25.0±0.5	20.4-21.0	20.7±0.2	-	9.6e-16 ***	0.914
pH	7.78-7.96	7.89±0.08	7.49-7.69	7.60±0.08	7.52-7.72	7.58±0.08	6~9	8.31e-05 ***	0.209
EC	260-357	289±41	324-370	334±20	308-464	361±66	-	0.0834	0.022*
DO (mg/L)	**4.58**-7.31	6.05±1.00	**3.63-4.35**	**3.98±0.32**	**1.98**-6.88	**4.43±2.24**	≥5mg/L	0.0938	0.585
BOD_5 (mg/L)	1.3-2.1	1.7±0.3	1.3-2.3	1.8±0.4	1.6-**4.9**	2.8±1.6	≤4mg/L	0.159	0.4
COD (mg/L)	10-**31**	**21±10**	11-**27**	18±7	10-**33**	17±10	≤20mg/L	0.775	0.352
KMnO4 (mg/L)	3.4-4.2	3.8±0.3	3.2-3.4	3.3±0.1	3.3-**6.8**	4.7±1.6	≤6mg/L	0.0892	0.369
TN (mg/L)	0.77-**2.21**	**1.26±0.63**	**1.63-4.82**	**2.69±1.33**	0.97-**7.28**	**2.81±2.61**	≤1mg/L	0.324	0.35
TP (mg/L)	0.09-0.19	0.14±0.05	0.08-0.13	0.10±0.02	0.07-**0.66**	**0.23±0.24**	≤0.2mg/L (≤0.05mg/L [a])	0.356	0.149
NO_3-N (mg/L)	0.09-0.57	0.21±0.20	0.6-1.41	0.85±0.32	0.24-0.35	0.29±0.05	≤10 mg/L	0.00133 **	0.4
NO_2-N (mg/L)	0.023-0.034	0.027±0.005	0.026-0.037	0.030±0.005	0.029-0.042	0.037±0.05	≤0.15mg/L	0.0161 *	0.169
PO_4-P (mg/L)	**0.06-0.14**	**0.10±0.03**	**0.06-0.08**	**0.07±0.01**	**0.06-0.53**	**0.19±0.20**	<0.02 mg/L	0.265	0.19
NH_4-N (mg/L)	0.254-**1.350**	0.731±0.527	0.86-**1.18**	0.95±0.13	0.54-**6.82**	**2.27±2.61**	≤1mg/L	0.272	0.16
TOC (mg/L)	5.2-6.1	5.7±0.4	3.7-4.0	3.8±0.1	3.6-5.4	4.2±0.7	-	0.000133 ***	0.347
Chl *a* (ug/L)	9.6-12.0	10.7±0.9	29.7-56.2	42.3±12.6	9.06-12.07	10.49±1.24	-	1.84E-05	0.382
TC (Log cfu/mL)	2.59-3.24	2.99±2.74	1.78-3.18	2.63±2.78	3.11-3.74	3.42±3.22	-	0.0271 *	0.39
FC (Log cfu/100mL)	**3.57-4.20**	**3.95±3.71**	**3.98-4.49**	**4.35±3.89**	**3.67-5.10**	**4.65±4.70**	≤3	0.324	0.0539

Table S6. Physicochemical and microbiological characteristics of DeDeTang (DDT) with statistical analyses.

	August		September		October		Guideline value (MEP Surface Water class III)	P-Value(difference between months)	P-Value(difference between samples)
	Range	Mean±SD	Range	Mean±SD	Range	Mean±SD			
AT (℃)	31.2-34.1	32.7±1.1	26-32.1	28.4±2.3	20.9-22.2	21.6±0.5	-	2.69e-07 ***	0.872
WT (℃)	32.4-34.2	33.3±0.6	25.6-26.6	26±0.4	21.3-22	21.7±0.3	-	1.88e-13 ***	0.997
pH	7.2-8.1	7.7±0.4	7.31-7.71	7.47±0.18	7.36-7.57	7.5±0.1	6~9	0.207	0.0516
EC	310-400	365±43	378-521	460±73	376-536	457±79	-	0.0753	0.0029**
DO (mg/L)	5.24-7.58	6.39±1.05	**4.26**-5.68	**4.63±0.59**	**4.68**-6.87	6.01±0.9	≥5mg/L	0.0184 *	0.842
BOD_5 (mg/L)	1.3-**4.1**	2.1±1.2	1.2-2.4	2.0±0.5	1.8-2.2	2.0±0.16	≤4mg/L	0.946	0.211
COD (mg/L)	12-**48**	**26±15**	**21-25**	**23±2**	18-**27**	**24±4**	≤20mg/L	0.886	0.888
KMnO4 (mg/L)	5.1-5.7	5.4±0.26	3.8-4.5	4.2±0.29	3.3-4.1	3.8±0.33	≤6mg/L	5.02e-06 ***	0.472
TN (mg/L)	0.73-0.97	0.87±0.1	**1.79-2.07**	**1.97±0.11**	**1.37-1.48**	**1.41±0.04**	≤1mg/L	8.63e-10 ***	0.794
TP (mg/L)	0.14-0.17	0.16±0.01	0.11-0.15	0.13±0.02	0.08-0.1	0.09±0.01	≤0.2mg/L (≤0.05mg/L [a])	4.9e-06 ***	0.916
NO_3-N (mg/L)	0.21-0.37	0.28±0.07	0.66-0.94	0.82±0.11	0.19-0.33	0.26±0.05	≤10 mg/L	1.51e-07 ***	0.892
NO_2-N (mg/L)	0.047-0.093	0.065±0.019	0.039-0.145	0.073±0.046	0.046-0.082	0.061±0.016	≤0.15mg/L	0.798	0.00105**
PO_4-P (mg/L)	**0.08-0.15**	**0.11±0.03**	**0.07-0.09**	**0.08±0.01**	**0.06-0.08**	**0.07±0.01**	<0.02 mg/L	0.00728 **	0.763
NH_4-N (mg/L)	0.045-0.306	0.113±0.111	0.040-0.190	0.072±0.066	0.070-0.340	0.158±0.117	≤1mg/L	0.427	0.177
TOC (mg/L)	4.4-5.1	4.7±0.3	4.6-5.2	4.9±0.31	4.3-4.9	4.6±0.25	-	0.204	0.0341*
Chl *a* (ug/L)	6.3-61.7	19.4±23.7	19.5-63.2	32.5±18.4	7.3-13.1	10.0±2.6	-	0.163	0.467
TC (Log cfu/mL)	2.00-3.22	2.67±2.82	1.18-2.24	1.85±1.84	2.04-3.60	3.02±3.22	-	0.662	0.645
FC (Log cfu/100mL)	2.40-**3.88**	**3.40±3.50**	**3.42-4.40**	**4.22±4.02**	1.88-**3.98**	**3.52±3.56**	≤3	0.0465 *	0.0628

Table S7. Physicochemical and microbiological characteristics of ZiXingTang (ZXT) river with statistical analyses.

	August		September		October		Guideline value (MEP Surface Water class III)	P-Value(difference between months)	P-Value(difference between samples)
	Range	Mean±SD	Range	Mean±SD	Range	Mean±SD			
AT (℃)	32.8-35.8	34.1±1.1	28.6-30.3	29.3±0.7	22.2-23.9	22.9±0.7	-	4.39e-10 ***	0.867
WT (℃)	32.8-35.0	33.7±0.9	26.3-27.8	27.1±0.6	22-24.5	22.7±1.0	-	4e-10 ***	0.959
pH	7.5-7.7	7.6±0.1	7.2-7.7	7.4±0.6	7.5-7.7	7.6±0.1	6~9	0.103	0.271
EC	288-429	326±59	373-626	447±111	351-504	412±77	-	0.109	0.0162*
DO (mg/L)	5.88-7.41	6.49±0.57	**4.69**-6.46	5.45±0.85	5.46-8.51	7.06±1.38	≥5mg/L	0.0672	0.175
BOD_5 (mg/L)	1.1-3.7	2±1.1	2.1-2.6	2.3±0.2	1.7-2.8	2.3±0.4	≤4mg/L	0.623	0.019*
COD (mg/L)	10-**39**	18±12	10-**25**	**20±6**	19-**31**	**24±5**	≤20mg/L	0.558	0.140
KMnO4 (mg/L)	4.1-5.6	4.8±0.6	3.6-4.6	4.2±0.4	3.9-4.6	4.3±0.3	≤6mg/L	0.177	0.324
TN (mg/L)	0.55-**1.13**	0.78±0.24	**1.68-2.3**	**1.97±0.23**	**1.27-1.78**	**1.39±0.21**	≤1mg/L	1.1e-05 ***	0.881
TP (mg/L)	0.19-**0.21**	0.2±0.008	0.14-0.16	0.15±0.01	0.11-0.17	0.13±0.03	≤0.2mg/L (≤0.05mg/L [a])	2.08e-05 ***	0.529
NO_3-N (mg/L)	0.14-0.62	0.32±0.189	0.84-0.96	0.90±0.05	0.2-0.35	0.28±0.06	≤10 mg/L	3.21e-06 ***	0.864
NO_2-N (mg/L)	0.057-0.14	0.09±0.039	0.024-0.047	0.036±0.009	0.02-0.085	0.042±0.025	≤0.15mg/L	0.0214 *	0.144
PO_4-P (mg/L)	0.028-0.111	0.06±0.039	0.040-0.050	0.04±0.004	0.040-0.110	0.07±0.035	≤1mg/L	0.281	0.155
NH_4-N (mg/L)	**0.11-0.2**	**0.15±0.044**	**0.1-0.13**	**0.1±0.02**	**0.07-0.1**	**0.08±0.01**	<0.02 mg/L	0.00757 **	0.338
TOC (mg/L)	4-4.6	4.3±0.3	4.4-5.2	4.9±0.4	4.1-4.7	4.4±0.3	-	0.0352 *	0.0157*
Chl *a* (ug/L)	3.46-32.6	18.7±11.7	10.7-60.3	30.9±18.7	8.6-12.8	10.5±1.7	-	0.0745	0.805
TC (Log cfu/mL）	1.70-3.30	2.69±2.93	0.00-2.98	2.63±2.63	1.40-2.29	2.15±1.83	-	0.537	0.163
FC (Log cfu/100mL）	2.40-**3.48**	**3.24±3.00**	2.94-**4.27**	**4.00±3.83**	**3.21-4.01**	**3.71±3.62**	≤3	0.0755	0.0758

Table S8. Physicochemical and microbiological characteristics of samples collected from Taihu lake source water protection area (Control locations) with statistical analyses.

	August		September		October		Guideline value (MEP Surface Water class III)	P-Value(difference between months)	P-Value(difference between samples)
	Range	Mean±SD	Range	Mean±SD	Range	Mean±SD			
AT (℃)	30.8-31.6	31.2±0.4	25.7-27.1	26.4±0.7	22.3-22.7	22.5±0.2	-	1.7e-06 ***	0.801
WT (℃)	30.6-30.7	30.7±0.1	25.7	25.7±0	20.4-20.5	20.5±0.1	-	9.36e-12 ***	0.993
pH	8.44-**9.17**	8.88±0.39	8.95-**9.32**	**9.19±0.21**	8.33-8.44	8.39±0.06	6~9	0.0234 *	0.351
EC	305-318	311±7	302-309	305±4	320-321	320±0.6	-	0.0123 *	0.44
DO (mg/L)	8.53-10.98	10.00±1.30	-	-	-	-	≥5mg/L	-	-
BOD_5 (mg/L)	1.2-1.3	1.3±0.1	1.3-1.4	1.3±0.1	1.5-1.7	1.6±0.1	≤4mg/L	0.0095 **	0.81
COD (mg/L)	10	10±0	13-**22**	17±5	17-**21**	18±2	≤20mg/L	0.0206 *	1
KMnO4 (mg/L)	2.8-3.1	2.9±0.2	2.4-2.7	2.6±0.2	3.2-3.3	3.3±0.1	≤6mg/L	0.00171 **	1
TN (mg/L)	0.33-0.5	0.41±0.09	**1.21-1.24**	**1.23±0.02**	0.26-0.5	0.36±0.01	≤1mg/L	3.27e-05 ***	0.973
TP (mg/L)	0.03	0.03±0	0.01-0.02	0.01±0.01	0.01-0.02	0.02±0.01	≤0.2mg/L (≤0.05mg/L [a])	0.011 *	0.381
NO_3-N (mg/L)	0.11-0.18	0.14±0.04	0.24-0.33	0.28±0.05	0.13-0.15	0.14±0.01	≤10 mg/L	0.00294 **	0.53
NO_2-N (mg/L)	0.003-0.1	0.06±0.004	ND	ND	ND	ND	≤0.15mg/L	0.0187 *	0.595
PO_4-P (mg/L)	ND	ND	ND	ND	ND	ND	<0.02 mg/L	-	-

NH_4-N (mg/L)	0.031-0.061	0.042±0.017	0.04	0.04±0	0.03	0.03±0	≤1mg/L	0.6	0.484
TOC (mg/L)	5.5-8.6	7.0±1.5	3.2-4.1	3.5±0.5	3.5-3.7	3.6±0.1	-	0.00642 **	0.77
Chl *a* (ug/L)	3.10-3.56	3.33±0.24	2.88-5.22	4.20±1.20	2.12-8.31	4.33±3.45	-	0.824	0.102
TC (Log cfu/mL）	1.13-1.22	1.16±0.28	-	-	1.48-1.81	1.31±1.62	-	0.0207 *	0.706
FC (Log cfu/100mL）	1.48-1.57	1.53±0.58	1.95-2.55	2.33±2.13	0.70-1.18	1.03±0.72	≤3	0.00146 **	0.487

Table S9. Two-way ANOVA results for physicochemical and microbiological parameters based on the interactions between study area and sampling time. Df: degree of freedom; Sum Sq: Sum of Square; Mean Sq: Mean of Square. Sig.Level: Significant levels, *(p<0.05), **(p<0.01), ***(p<0.001).

Parameter	Variables	Df	Sum Sq	Mean Sq	F value	p value	Sig.Level
	Area	4	25.4	6.4	5.821	<0.001	***
AT	Month	2	1408.8	704.4	644.522	<0.001	***
Area x Month	Area : Month	8	46.8	5.8	5.349	<0.001	***
	Residuals	60	65.6	1.1			
	Area	4	21.7	5.4	19.388	<0.001	***
WT	Month	2	1586.5	793.3	2831.752	<0.001	***
Area x Month	Area : Month	8	15.2	1.9	6.792	<0.001	***
	Residuals	60	16.8	0.3			
	Area	4	7.259	1.8148	59.674	<0.001	***
pH	Month	2	0.689	0.3447	11.333	<0.001	***
Area x Month	Area : Month	8	0.629	0.0786	2.585	0.017	*
	Residuals	60	1.825	0.0304			
	Area	4	90001	22500	8.104	<0.001	***
EC	Month	2	98640	49320	17.764	<0.001	***
Area x Month	Area : Month	8	22231	2779	1.001	0.445	
	Residuals	60	166587	2776			
	Area	4	364642	91160	66.289	<0.001	***
Chl *a*	Month	2	63629	31814	23.134	<0.001	***
Area x Month	Area : Month	8	91692	11462	8.334	<0.001	***
	Residuals	60	82512	1375			
	Area	4	36.36	9.091	7.905	<0.001	***
DO	Month	2	40.45	20.227	17.587	<0.001	***
Area x Month	Area : Month	8	7.41	0.926	0.805	0.601	
	Residuals	60	69	1.15			
	Area	4	83.27	20.817	70.871	<0.001	***
$KMnO_4$	Month	2	5.75	2.875	9.786	<0.001	***
Area x Month	Area : Month	8	13.05	1.631	5.553	<0.001	***
	Residuals	60	17.62	0.294			

	Area	4	0.04247	0.010619	2.322	0.067	
TP	Month	2	0.03835	0.019177	4.193	0.0198	*
Area x Month	Area : Month	8	0.09277	0.011596	2.535	0.019	*
	Residuals	60	0.27444	0.004574			
	Area	4	0.04325	0.010811	3.568	0.01122	*
PO_4-P	Month	2	0.02753	0.013764	4.543	0.01455	*
Area x Month	Area : Month	8	0.07362	0.009202	3.037	0.00621	**
	Residuals	60	0.1818	0.00303			
	Area	4	14.04	3.51	4.163	0.00484	**
TN	Month	2	9.31	4.654	5.52	0.0063	**
Area x Month	Area : Month	8	7.06	0.882	1.046	0.41254	
	Residuals	60	50.58	0.843			

Parameter	**Variables**	**Df**	**Sum Sq**	**Mean Sq**	**F value**	**p value**	**Sig.Level**
	Area	4	21.519	5.38	10.928	<0.001	***
NH_4-N	Month	2	4.838	2.419	4.914	0.0106	*
Area x Month	Area : Month	8	4.852	0.606	1.232	0.2965	
	Residuals	60	29.537	0.492			
	Area	4	0.04059	0.010148	13.447	<0.001	***
NO_2-N	Month	2	0.00272	0.001359	1.8	0.174	
Area x Month	Area : Month	8	0.01602	0.002002	2.653	0.0146	*
	Residuals	60	0.04528	0.000755			
	Area	4	0.931	0.2328	8.454	<0.001	***
NO_3-N	Month	2	6.002	3.0008	108.978	<0.001	***
Area x Month	Area : Month	8	0.168	0.021	0.763	0.636	
	Residuals	60	1.652	0.0275			
	Area	4	115.64	28.91	257.36	<0.001	***
TOC	Month	2	30.7	15.348	136.63	<0.001	***
Area x Month	Area : Month	8	30.74	3.843	34.21	<0.001	***
	Residuals	60	6.74	0.112			
	Area	4	8130	2032.4	8.545	<0.001	***
COD	Month	2	2329	1164.3	4.895	0.0107	*
Area x Month	Area : Month	8	4676	584.5	2.458	0.0226	*

	Residuals	60	14270	237.8			
	Area	4	106.8	26.693	3.051	0.0235	*
BOD	Month	2	13.4	6.721	0.768	0.4683	
Area x Month	Area : Month	8	75.4	9.423	1.077	0.3913	
	Residuals	60	524.9	8.748			
	Area	4	10.052	2.5129	14.41	<0.001	***
TC	Month	1	0.074	0.0737	0.423	0.519	
Area x Month	Area : Month	4	1.374	0.3435	1.97	0.118	
	Residuals	40	6.976	0.1744			
	Area	4	14.028	3.507	16.137	<0.001	***
FC	Month	2	5.814	2.907	13.377	<0.001	***
Area x Month	Area : Month	8	1.666	0.208	0.958	0.477	
	Residuals	60	13.04	0.217			
	Area	4	15.277	3.819	14.239	<0.001	***
BacUni	Month	2	18.528	9.264	34.538	<0.001	***
Area x Month	Area : Month	8	8.313	1.039	3.874	<0.001	***
	Residuals	60	16.093	0.268			
	Area	4	8.753	2.188	14.188	<0.001	***
HF183	Month	2	8.452	4.226	27.4	<0.001	***
Area x Month	Area : Month	8	11.902	1.488	9.647	<0.001	***
	Residuals	60	9.254	0.154			

Table S10. The specific explanations of each land use classification.

No.	Land Use Classification	Explanation
1	Administrative Land	Government agencies, non-profit organizations and other facility land
2	Agricultural Land	Arable land, forest land, farming land, grassland, agricultural facilities and the like
3	Class A Industrial Land	Pollution-free industrial land, minimal or no adverse influence to residential area or public environment
4	Class B Industrial Land	Low-pollution industrial land, certain adverse influence to residential area or public environment
5	Class C Industrial Land	Severe adverse influence to residential area or public environment
6	Commercial and Residential Mixed Land	Land used for both commercial and residential land
7	Commercial Land	All sorts of commercial, business and entertainment use facility
8	Cultural Entertainment Land	Libraries, exposition etc. cultural facility land
9	Education & Research Land	Higher-education institution, secondary technical education institution, middle schools, primary schools, research institutions, as well as affiliated dormitories
10	High Density Residential Land	High rise residence with relatively complete amenity
11	Hospital	Hospital, clinic, health care, habitation related land
12	Low Density Residential Land	Low-rise residence
13	Logistic and Warehousing Land	Land for cargo storage, transfer or delivery
14	Medium Density Residential Land	Walk-ups residence with relatively complete amenity
15	Municipal Utilities	Land for facilities providing services, environment and safety
16	Public Greenland	Open for public primarily for recreational purpose
17	River & Lake	Non-development land, all sorts of water bodies
18	Road	Urban road and traffic facility land
19	Plaza	Urban public spaces for recreational, memorial, gathering purposes
20	Undeveloped Land	Land not yet in use, such as saline land, sandy land, bare land, bare fertile land etc.

Supplementary Figures

Figure S1. Surrounding environment near LiPuDang (LPD) sampling locations. LPD is surrounded by high percentage of public Greenland, agriculture land low density residential land.

Figure S2. Surrounding environment near XiDaGang (XDG) sampling locations. XDG River flows through dense agriculture lands and is function as the direct source of agricultural water. The surrounding areas include Class B and C industrial lands.

Figure S3. Surrounding environment near WFG sampling locations. WFG is a narrow river flows through dense class A industrial land with some public Greenland, providing direct source for industrial water but treated plant effluent of theses factories also come into this river.

Figure S4. Surrounding environment near DaDeTang (DDT) sampling locations. DDT is a small river flows through public Greenland, agricultural land and Class A and B industrial lands.

Figure S5. Surrounding environment near ZiXingTang (ZXT) sampling locations. ZXT is a long river flows through some tourist attractions of Wujiang, surrounded by mostly public greenland and large agricultural lands. Several class B industries are around this river (except location 22). A small proportion of class A industrial land are present around locations 21-24 and class C industrial land near location 25.

Figure S6. Spearman's correlation map of the physicochemical, microbiological and land use pattern percentages (if applicable) for a) LPD and b) XDG. Each correlation was presented by one coloured circle in the figure. The blue colour indicated positive correlations, while the red colour indicated negative correlations. Depth of the colours and sizes of the circles indicated strengths of the correlations. Non-significant ($p>0.05$) correlations were presented by a cross on the circle. Factors were excluded if they were either unavailable or identical through locations.

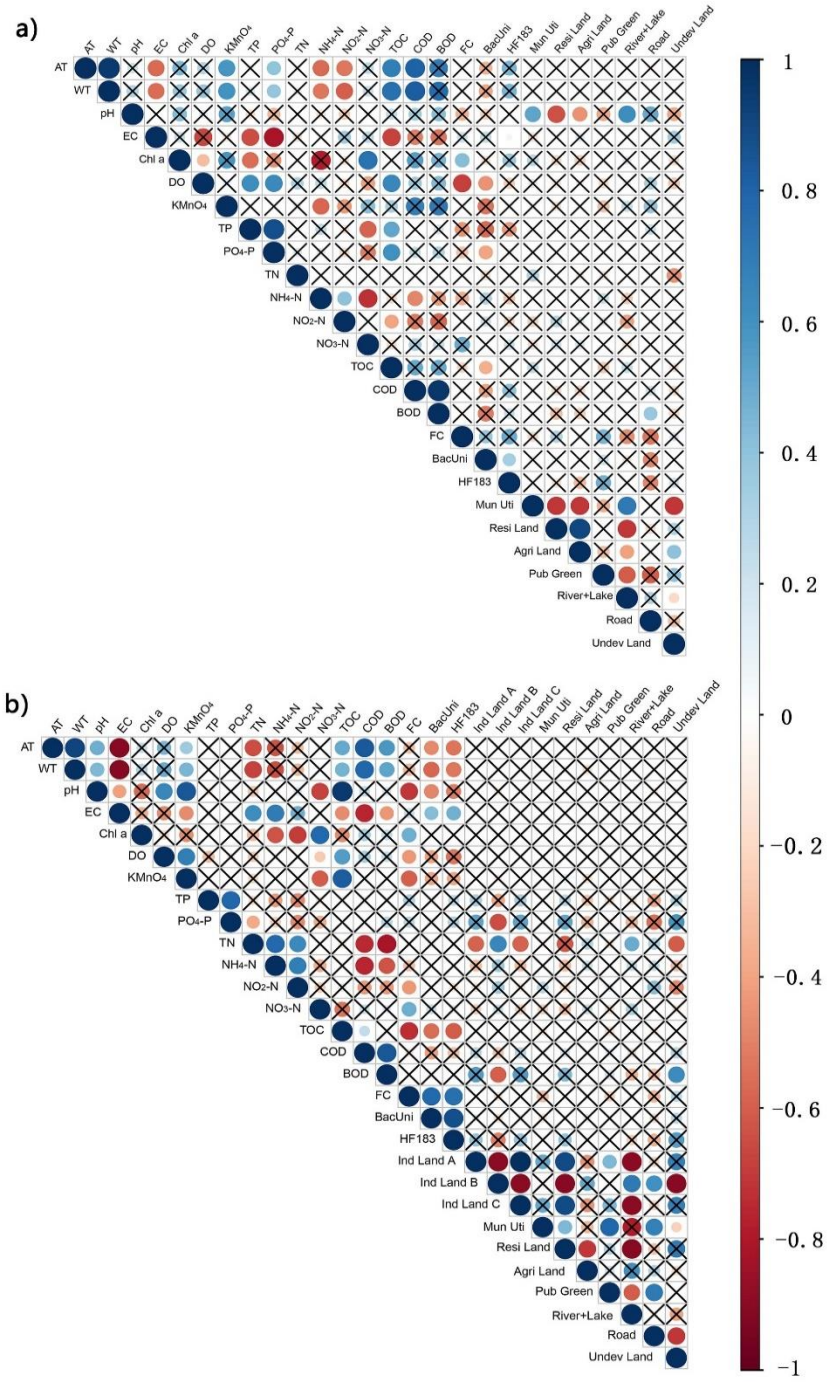


Figure S7. Spearman's correlation map of the physicochemical, microbiological and land use pattern percentages (if applicable) for a) WFG and b) DDT. Each correlation was presented by one coloured circle in the figure. The blue colour indicated positive correlations, while the red colour indicated negative correlations. Depth of the colours and sizes of the circles indicated strengths of the correlations. Non-significant (p>0.05) correlations were presented by a cross on the circle. Factors were excluded if they were either unavailable or identical through locations.

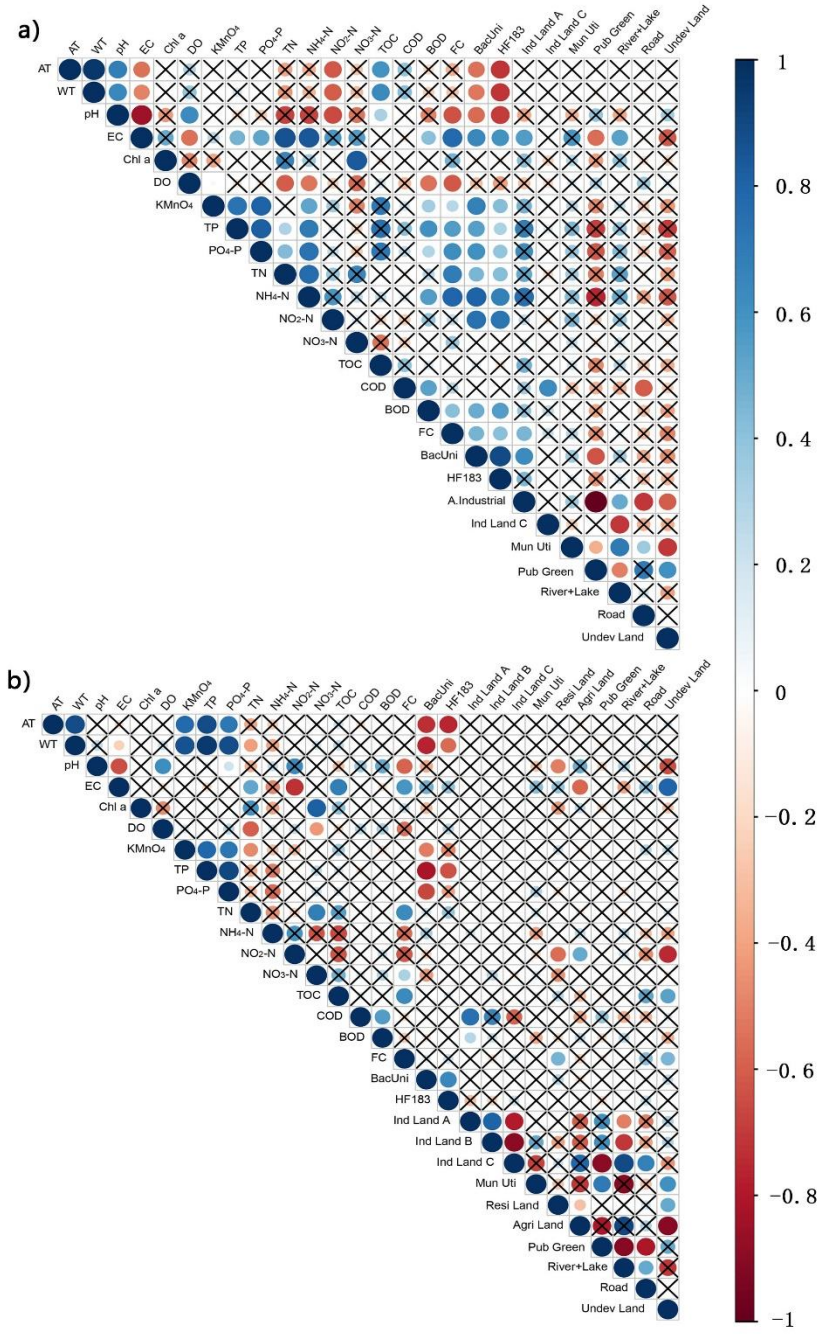
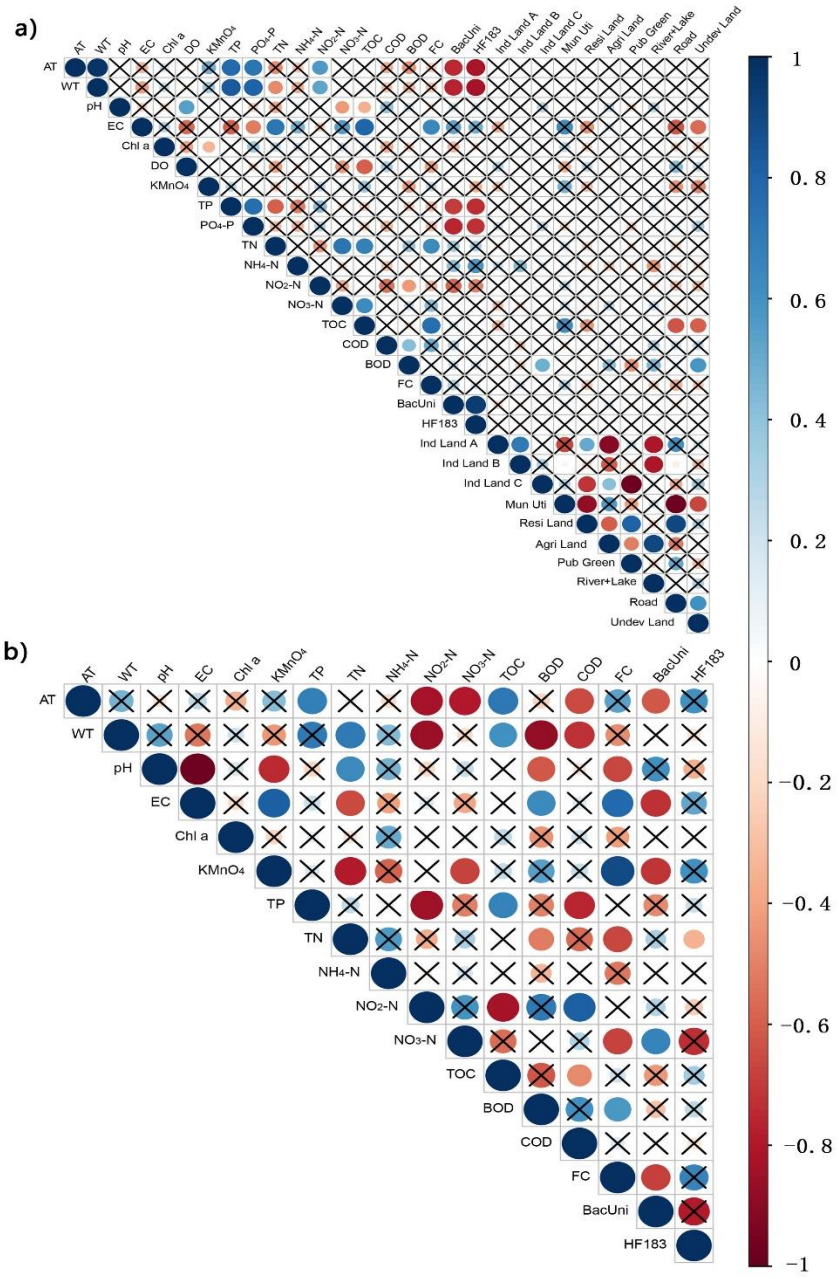


Figure S8. Spearman's correlation map of the physicochemical, microbiological and land use pattern percentages (if applicable) for a) ZXT and b) Control area. Each correlation was presented by one coloured circle in the figure. The blue colour indicated positive correlations, while the red colour indicated negative correlations. Depth of the colours and sizes of the circles indicated strengths of the correlations. Non-significant ($p>0.05$) correlations were presented by a cross on the circle. Factors were excluded if they were either unavailable or identical through locations.



Spearman correlations between variables (Figures S6-S8)

Figure S6a. LiPuDong (LPD) Lake: The correlations among the LPD samples showed little significance. EC, NH_4-N and NO_2-N were negatively correlated to both AT and WT, while $KMnO_4$, PO_4-P, TOC and COD were positively correlated with temperatures. EC correlated negatively with TP, PO_4-P and TOC, which were well inter-correlated. The pH was higher around municipal utilities, lakes and rivers and lower around low-density residential land and agricultural land. Chl *a* correlated well and positively with NO_3-N. NH_4-N and NO_2-N were also correlated positively with each other.

Figure S6b. XiDaGang (XDG) River: In XDG, EC, TN and the fecal MST markers BacUni and HF183 were negatively correlated with temperatures. The pH, TOC, COD, BOD and $KMnO_4$ were well positively correlated with temperatures. The pH increased DO, $KMnO_4$ and TOC, while it decreased with EC, NO3-N and fecal contamination. EC correlated negatively with $KMnO_4$, TOC, COD and BOD, but positively with TN, NH_4-N and fecal MST markers. TP and PO_4-P were strongly positively correlated. TN had a positive relationship with NH_4-N and NO_2-N, but not with NO_3-N. Meanwhile, TN and NH_4-N were also negatively correlated with COD and BOD. TOC had a negative correlation with the fecal contamination parameters. As for land uses, TN was correlated negatively with class A and C industrial lands and undeveloped land, yet positively with class B industrial land, river and lake. A negative correlated was observed between PO_4-P and class B industrial land. BOD correlated negatively with class B industrial land and positively with undeveloped land.

Figure S7a WuFangGang (WFG) River: In WFG, EC, NO_2-N and the fecal MST markers were negatively correlated with AT and WT, while pH and TOC positively correlated with temperatures. The pH had strong and significant negative correlations with EC, NO_2-N and fecal contamination parameters, and it correlated positively with DO and TOC. Almost oppositely, EC correlated negatively with DO, but positively with P and N nutrient parameters and fecal contamination parameters. Chl *a* levels associated well with NO_3-N levels. In this river, $KMnO_4$, TP, PO_4-P, TN and NH_4-N were found to have similar trends. These nutrient-related parameters also correlated well with fecal and organic pollution parameters (BOD, FC, BacUni and HF183). Class A industrial land showed positive correlations with EC, FC and BacUni, while lass C industrial land correlated positively only with COD. Public green land had negative relationships with EC and BacUni. River and lake correlated positively with EC, and road correlated negatively with COD.

Figure S7b. DaDeTang (DDT) River: Only a few significant correlations were observed in DD. The fecal MST markers were negatively correlated with AT and WT, while $KMnO_4$, TP, PO_4-P positively correlated with temperatures. The pH changed positively with DO and PO_4-P, and negatively with EC, FC and percentages of low-density residential land. EC correlated positively with TN, TOC, FC and percentages of undeveloped land. EC also had a negative relationship with NO_2-N and percentages of agricultural land. Similar to the other rivers or lakes, Chl *a* levels correlated well with NO_3-N levels. Strong correlations were observed among $KMnO_4$, TP and PO_4-P. Different to other rivers or lake, TN in DDT correlated positively only with NO_3-N and FC, indicating that the possible main source of TN in DDT was NO_3-N. NO_2-N correlated negatively with low-density residential land and undeveloped land percentages, while it positively correlated with percentages of agricultural land. TOC had a

positive relationship with both FC and undeveloped land. COD correlated strongly and positively with class A industrial land. FC correlated positively with low-density residential land and undeveloped land percentages.

Figure S8a. ZiXingTang (ZXT) River: In ZXT, the fecal MST markers had very strong negative correlations with AT, WT, TP and PO_4-P. This might be due to a sharp increase of fecal contamination in the month of October, when the temperatures dropped. TP, PO_4-P and NO_2-N were positively correlated with temperatures. EC positively correlated with TN, TOC, FC, and negatively with PO_4-P. TP andPO_4-P were well positively correlated, similar to the other study areas. TN in DDT correlated positively mainly with NO_3-N, TOC and FC, indicating that NO_3-N was possibly the main source of TN in this area. FC levels correlated positively with EC, TN and TOC. Land use patterns did not correlate much with the physico-chemical parameters. Percentages of class C industrial land and undeveloped land correlated positively with BOD. Undeveloped land also had a negative correlation with EX and TOC. TOC also had a negative relationship with percentages of roads.

Figure 8b. Control locations: The control sample size was smaller in total, compared to the other study areas. Non-significant correlation were easily observed. Generally TN, TP and TOC decreased with sampling times and temperatures. However, increased NO_2-N, NO_3-N, BOD and COD were observed in colder weathers. The pH correlated negatively with EC, $KMnO_4$, BOD and FC, but positively with TN. On the contrary, EC correlated positively with EC, $KMnO_4$, BOD and FC, but negatively with TN and BacUni. $KMnO_4$ levels changed negatively.