

Supplementary Material

Assessing Land-Cover Effects on Stream Water Quality in Metropolitan Areas Using the Water Quality Index

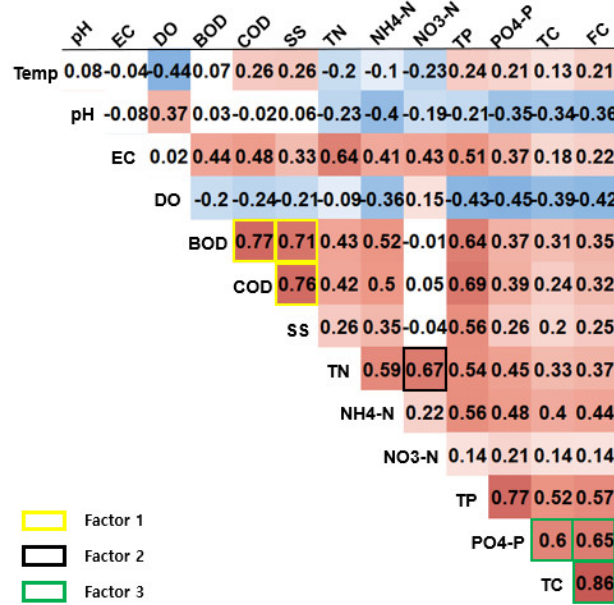
TaeHo Kim, YoungWoo Kim, Jihoon Shin, ByeongGeon Go and YoonKyung Cha *

School of Environment Engineering, University of Seoul, 163, Seoulsiripdae-ro, Dongdaemun-gu, Seoul 02504, Korea; willy1995@uos.ac.kr (T.H.K.); youngwoo0508@uos.ac.kr (Y.W.K.); sjh3473@uos.ac.kr (J.S.); rhqudrjs7@uos.ac.kr (B.G.G.)

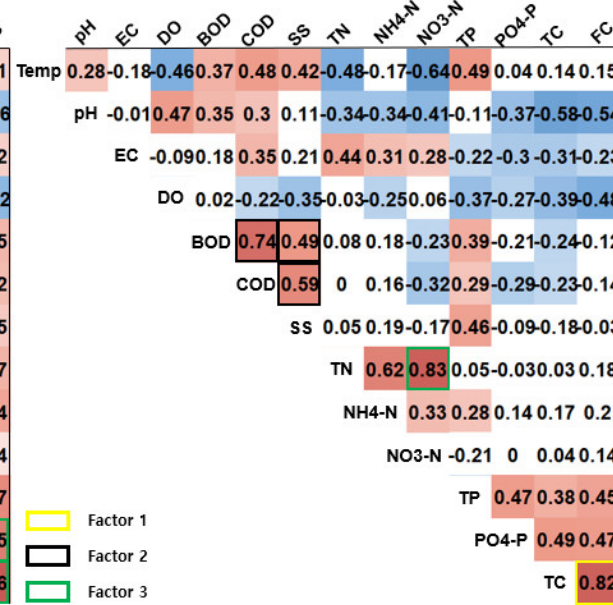
* Correspondence: ykcha@uos.ac.kr

Received: 7 October 2020; Accepted: 21 November 2020; Published: date

(a) URB



(b) AGR



(c) FOR

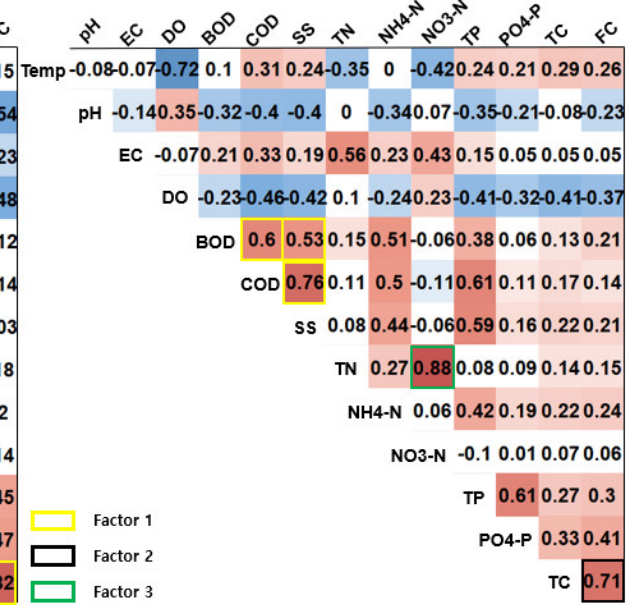


Figure S1. Matrices of the Pearson's correlation coefficient for the period 2015–2016 among 14 water quality parameters for (a) urban-dominated (URB), (b) agricultural-dominated (AGR), and (c) forest-dominated (FOR) land-cover. Water quality parameters with high factor loadings (>0.75) on the same factor are outlined in the same color.

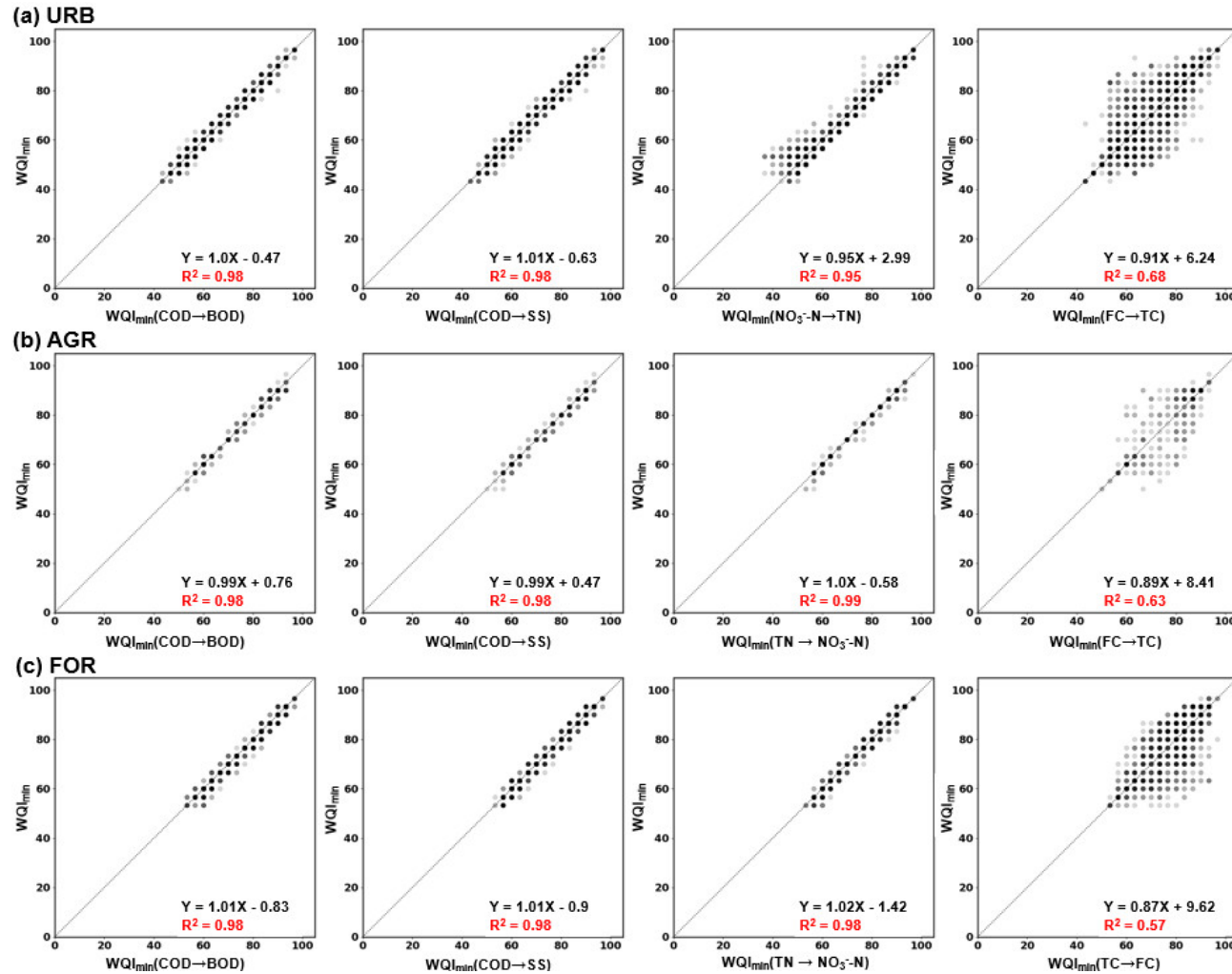


Figure S2. Relationships between the minimum water quality index (WQI_{min}) and modified WQI_{min} from 2015 to 2018. To develop the modified WQI_{min} , key parameter values were predicted using the established linear relationship between a key parameter and a surrogate parameter. Then, predicted values were converted into normalization factors for WQI_{min} calculation. In the x-axis label, $WQI_{min}(COD \rightarrow BOD_5)$ indicates that biochemical oxygen demand (BOD_5) was used as the surrogate for the key parameter of chemical oxygen demand (COD). Black dotted lines indicate 1:1 lines.

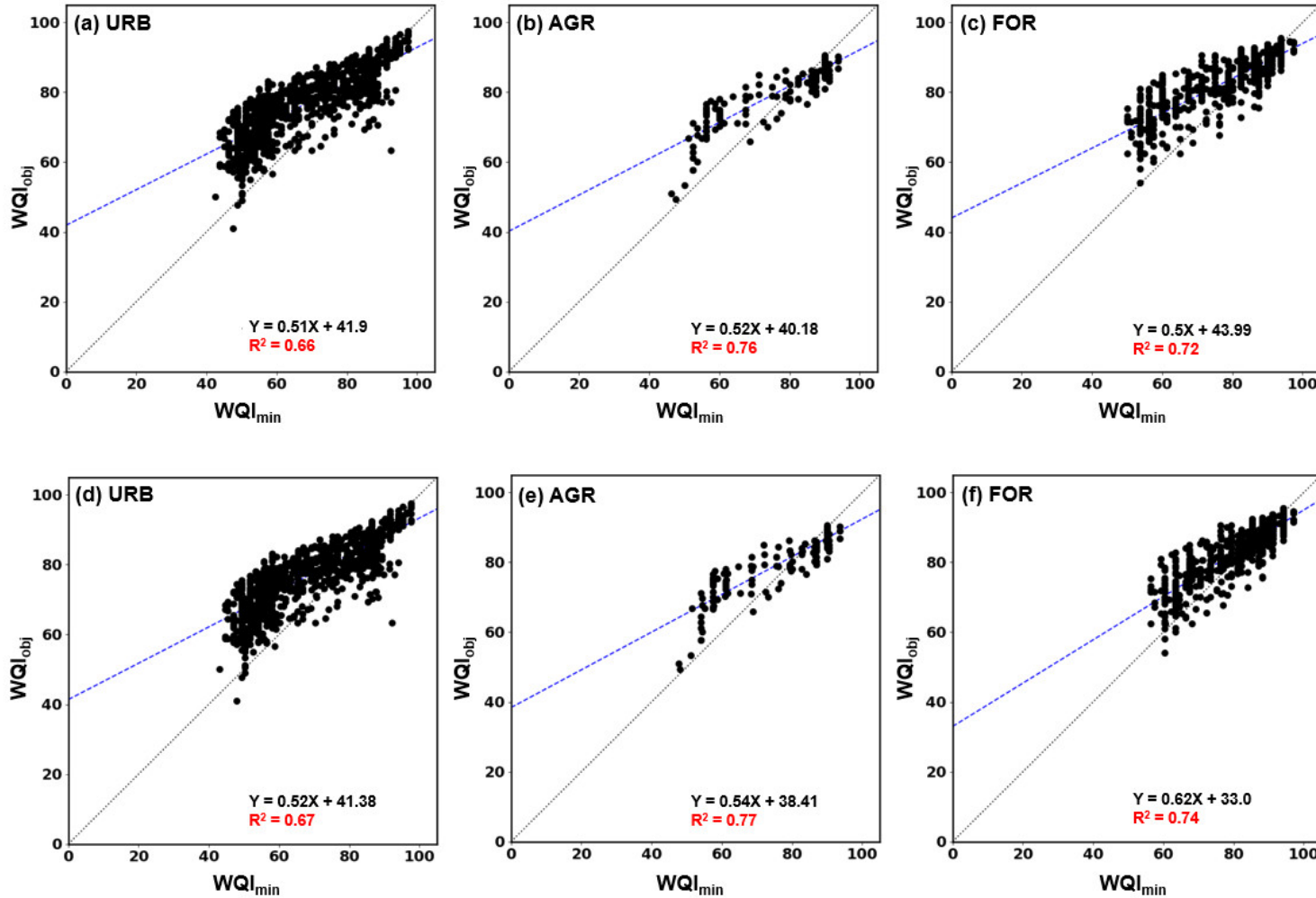


Figure S3. Relationships between objective and minimum water quality indices (WQI_{obj} and WQI_{min}) from 2017 to 2018. Weights were determined using two methods; for **a–c**, a relative weight was assigned to each key parameter and for **d–f**, the percent variance explained by a given extracted factor was assigned to each key parameter. Black dotted lines and blue dashed lines indicate 1:1 lines and regression lines, respectively.

Table S1. Proportions of three land-cover categories (urban, agricultural, and forested land) for urban-dominated watersheds (URB), agriculture-dominated watersheds (AGR), and forest-dominated watersheds (FOR).

Watershed type	Statistic	Land-cover category		
		Urban (or built-up)	Agricultural	Forested
URB	Average	0.50	0.06	0.30
	Standard deviation	0.12	0.05	0.10
	Max	0.72	0.16	0.43
	Min	0.31	0.00	0.09
AGR	Average	0.16	0.44	0.24
	Standard deviation	0.07	0.08	0.07
	Max	0.28	0.52	0.33
	Min	0.09	0.32	0.14
FOR	Average	0.12	0.16	0.60
	Standard deviation	0.06	0.04	0.08
	Max	0.26	0.22	0.75
	Min	0.03	0.08	0.47

Table S2. Parallel analysis results comparing eigenvalues and simulated mean eigenvalues for urban-dominated (URB), agriculture-dominated (AGR), and forest-dominated (FOR) land-cover. The simulated mean eigenvalue indicates the mean eigenvalue calculated from randomly generated simulation data. Asterisks (*) indicate that the eigenvalue is higher than the corresponding simulated mean eigenvalue.

Factor	Watershed type					
	URB		AGR		FOR	
	Eigenvalue	Simulated mean eigenvalue	Eigenvalue	Simulated mean eigenvalue	Eigenvalue	Simulated mean eigenvalue
Factor 1	*5.64	1.21	*3.65	1.58	*4.47	1.26
Factor 2	*2.10	1.16	*3.41	1.43	*2.61	1.20
Factor 3	*1.98	1.13	*2.74	1.31	*1.78	1.15
Factor 4	0.93	1.09	1.04	1.22	1.03	1.11