Supporting information for

Estimating rainfall-induced inflow and infiltration in the sanitary sewer system based on water quality modelling: which parameter to use?

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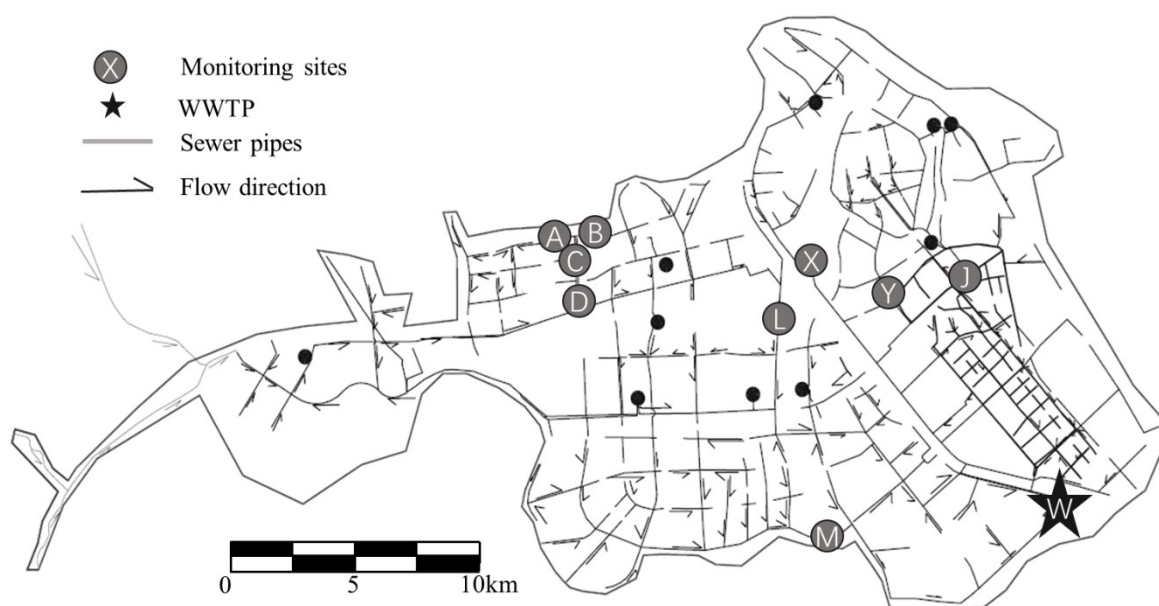
Figure S1 The monitoring sites, including four sites in one residential area (A, B, C, D), 5 pump stations (J, L, M, X, Y), and one WWTP (W)
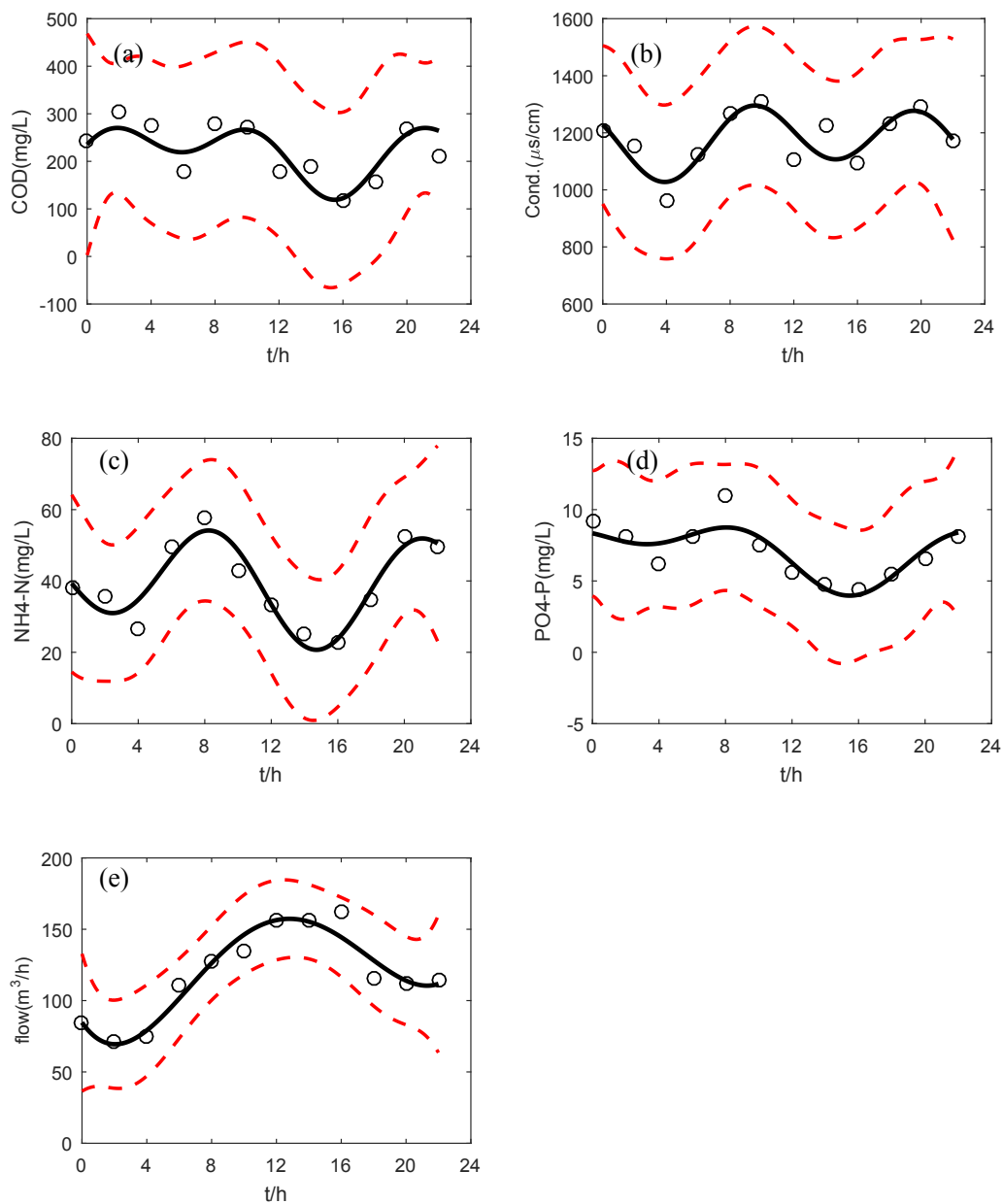
Figure S2 Dry weather fitting result of (a) COD (b) conductivity (c) NH_4^+-N (d) PO_4^{3-}-P (e) flow with Fourier series: for monitoring site D in residential area as an example. This showed that the peak pollutant concentration appeared around 8 o'clock and 20 o'clock, while the peak flow occurs between 12 o'clock and 14 o'clock.
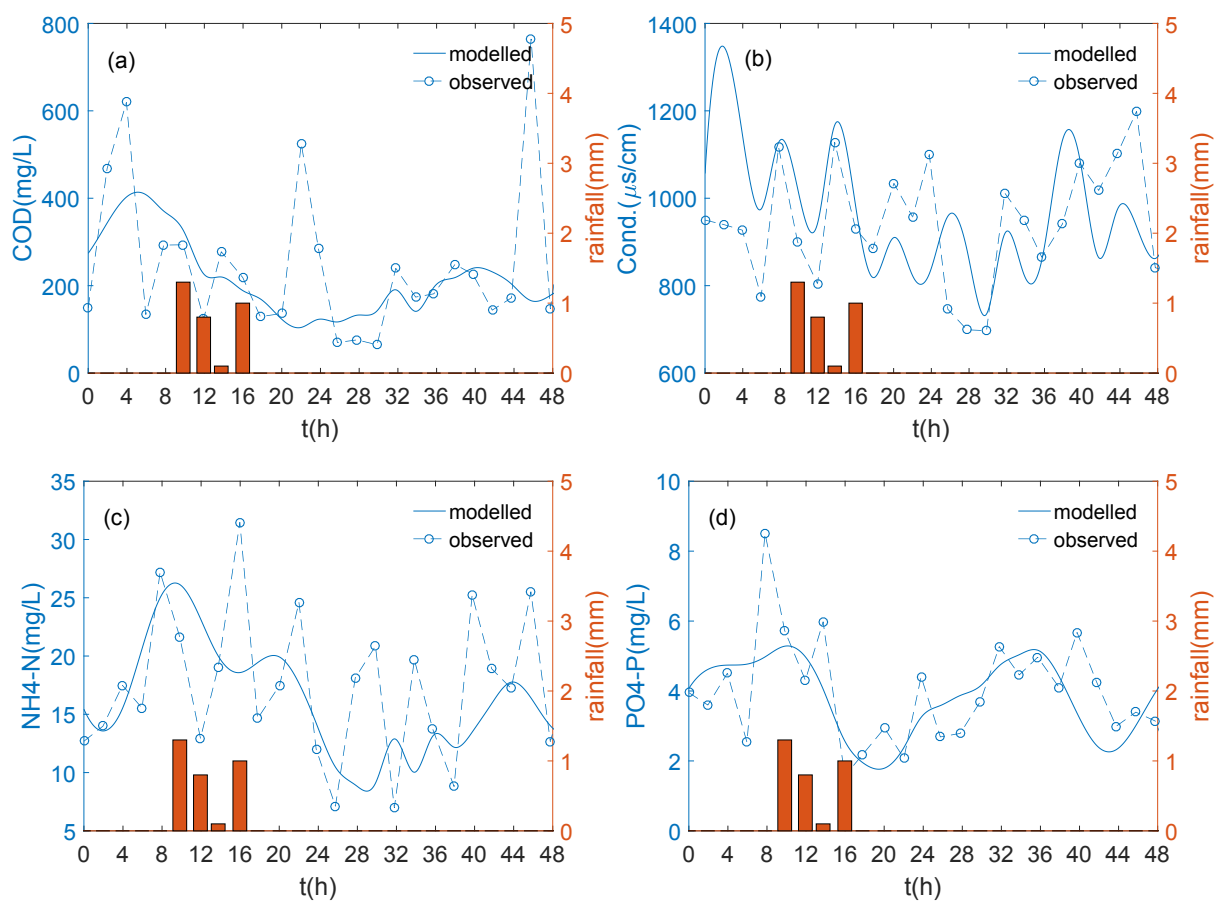
Figure S3. Fitting results of wastewater (a) COD (b) conductivity (c) NH4-N (d) PO4-P in site A
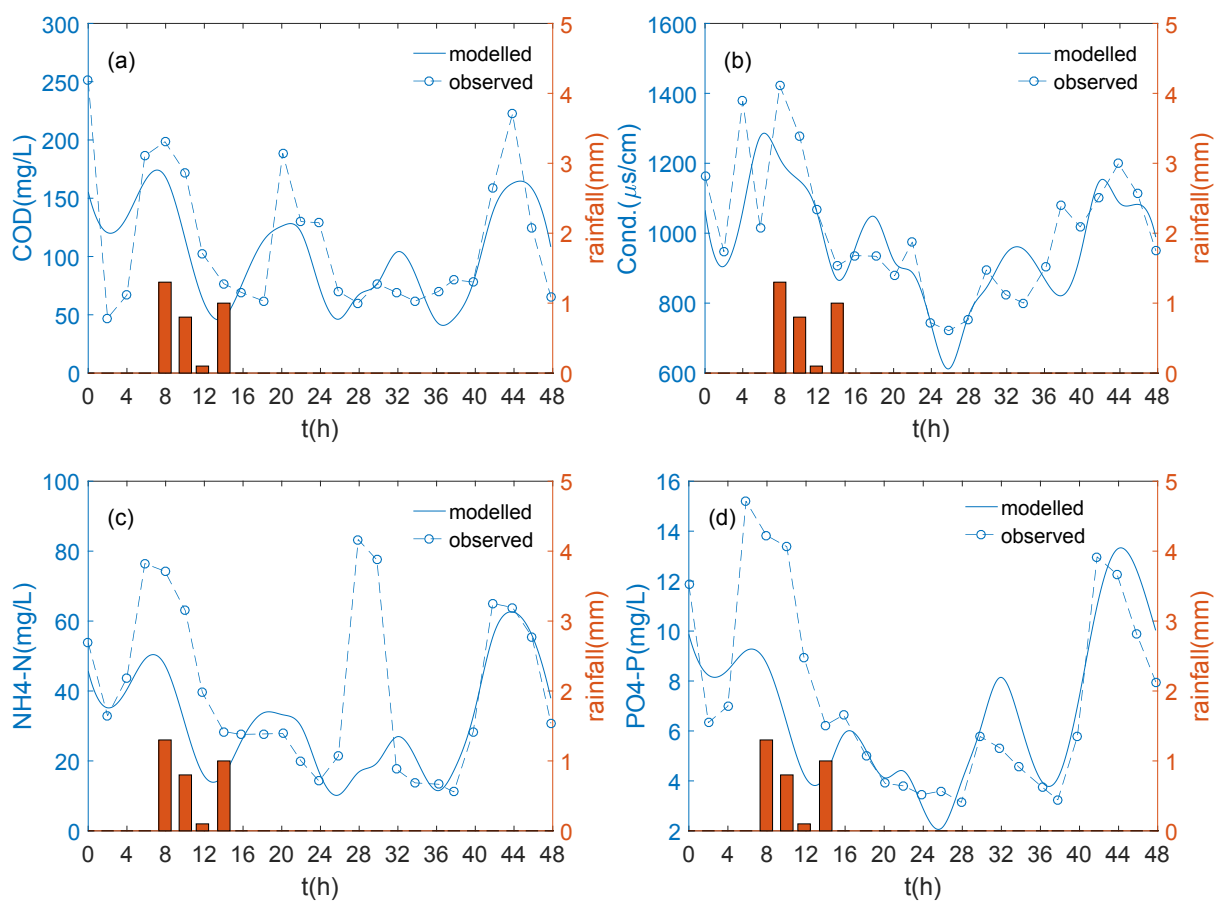
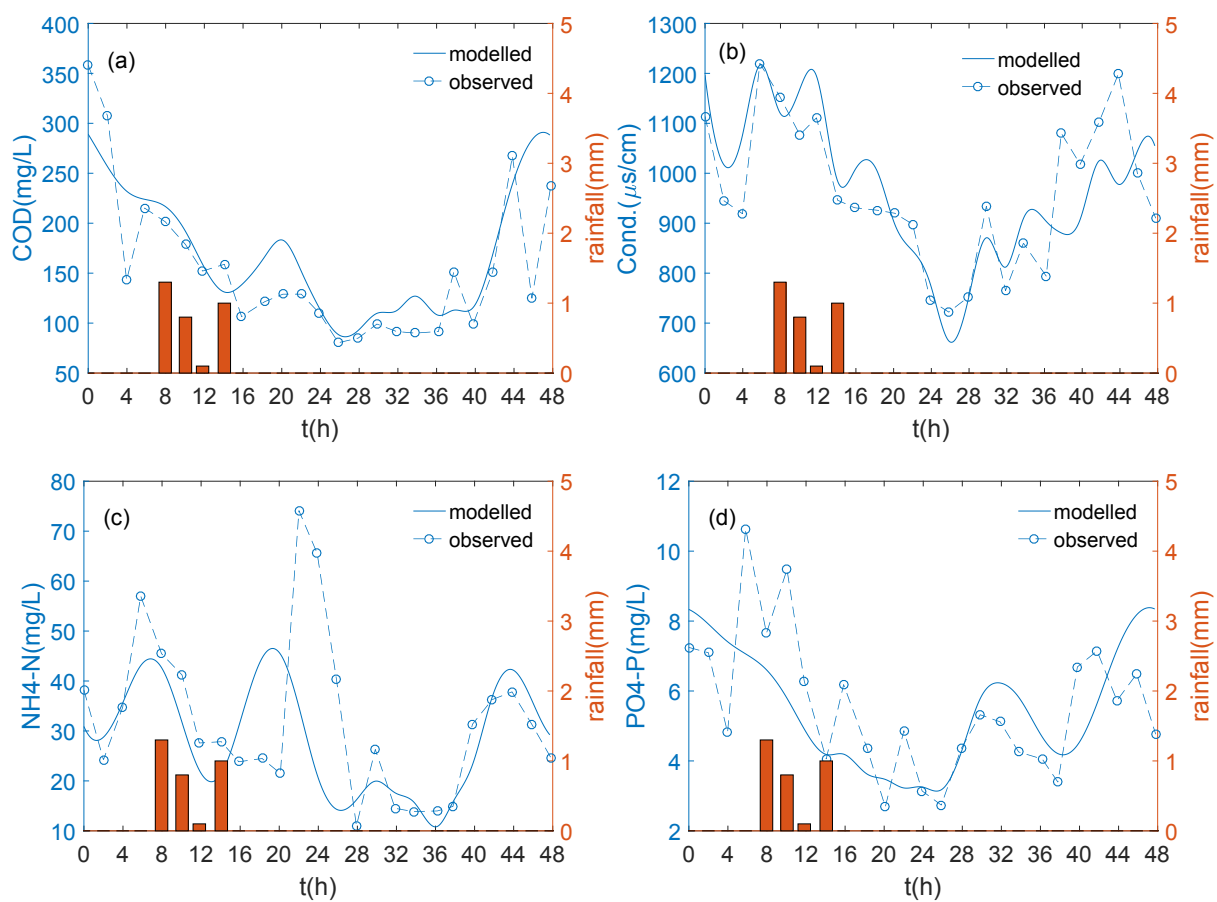Figure S4. Fitting results of wastewater (a) COD (b) conductivity (c) NH4-N (d) PO4-P in site B

Figure S5. Fitting results of wastewater (a) COD (b) conductivity (c) NH4-N (d) PO4-P in site C
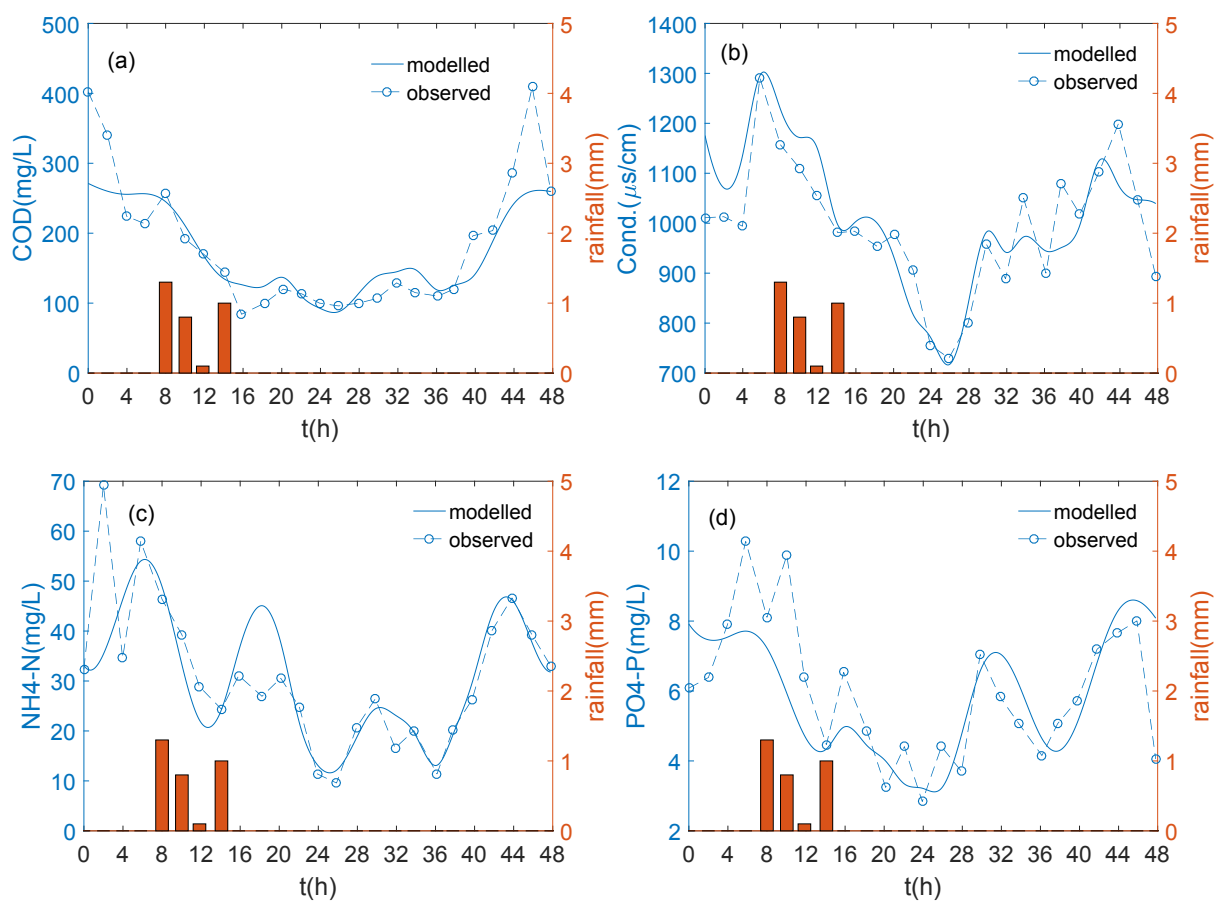
Figure S6. Fitting results of wastewater (a) COD (b) conductivity (c) NH4-N (d) PO4-P in site D
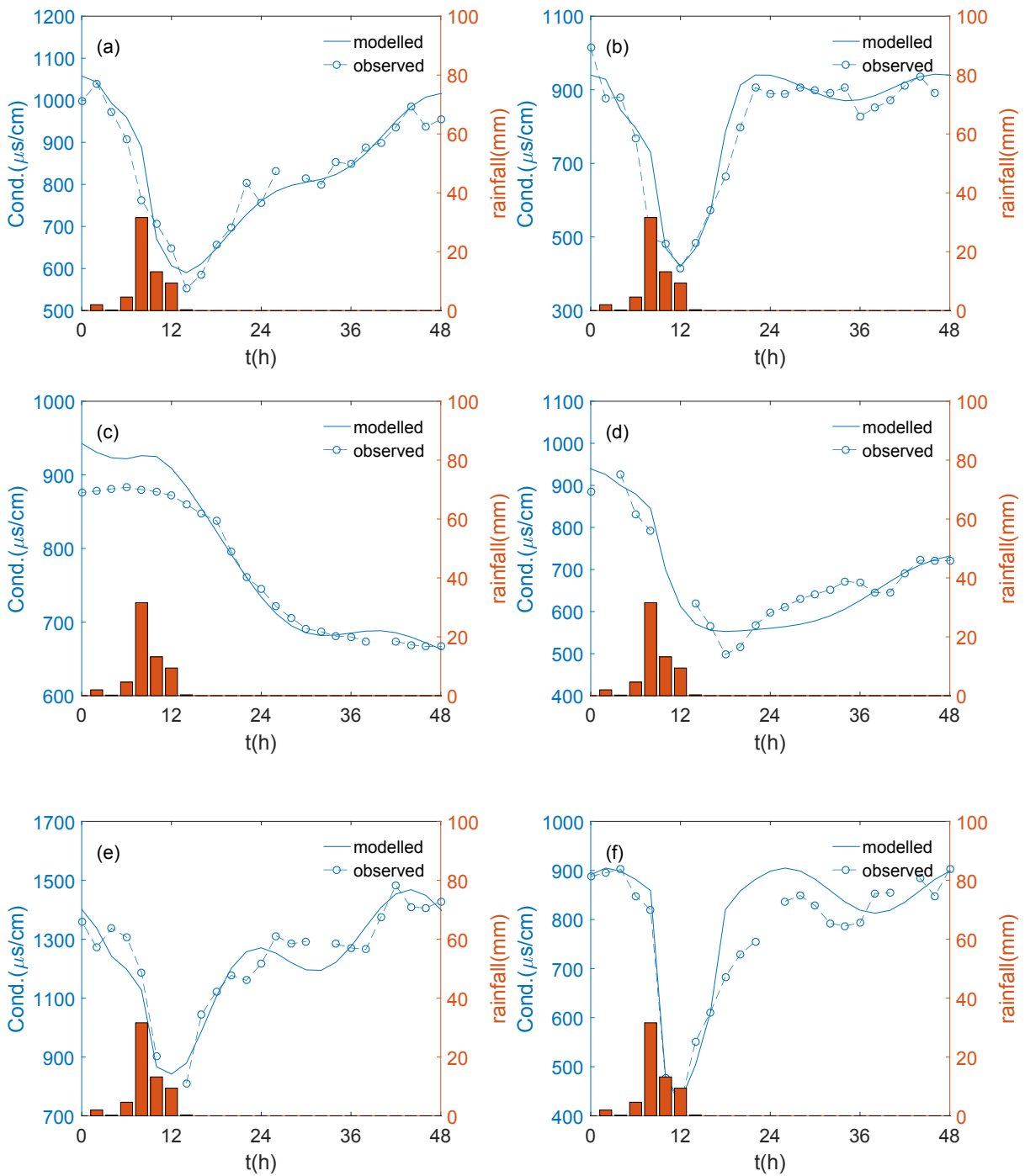
Figure S7 The fitting result of conductivity in pump station and WWTP (a) W (b) J (c) L (d) M (e) X (f) Y. Symbols refer to the monitoring sites as defined in Figure 1.

Table S1 Parameters of RDII in different spatial scale

	R_{RDI}	R_{RII}	K_{RDI}	N_{RDI}	K_{RII}	N_{RII}
A	10.6	5.5	17.1	1.3	17.4	5.3
B	17.9	10.2	7.2	3	19.7	4.3
C	18.5	4.8	4.5	4.1	18.7	4.2
D	16.5	12.5	3.9	4.5	19.6	4.7
W	1.2	0.7	9.7	2	12.5	3.9
J	1.1	0.6	5.6	1.9	15.1	2.9
L	2.6	1.2	5.7	6.1	18.5	7.2
M	3.6	1.4	8.1	1.9	12.9	4.2
X	1	0.1	5.3	2.4	9.2	3.7
Y	1.2	0.4	2.8	2.6	10.5	3.2

According to the results, the effects of RDII were the most significant for the WWTP (site W) comparing with other monitoring sites, since the site of WWTP had the lowest conductivity during the rainfall events. The inflow rate R_{RDI} and infiltration rate R_{RII} in pump station M were larger than that in pump station X and Y. This phenomenon suggests that severe situations such as misconnect or broken of pipe may have been taken place at the upstream part of the pump station M, while that is not the case for the pump stations X and Y. In residential area, the inflow rate R_{RDI} and infiltration rate R_{RII} at site B were larger than that at site A. Since the sub-catchment area corresponding to site B is larger than that to site A, the total amount of R_{DII} induced by per unit rainfall on sub-catchment B will be larger than that on sub-catchment A. The inflow rate R_{RDI} at site D is smaller than that at site C, but the infiltration rate R_{RII} at site D is larger than site C, showing there is breakage between C and D and some groundwater entering into the pipe as infiltration. Parameter K_{RDI}, N_{RDI}, K_{RII}, N_{RII} is different in these sites. These parameters determine the RDI and RII process of each sub-catchment and the difference reflect the comprehensive effect of soil type, pipe slope, and sewer roughness.