

Supplementary Material

As shown in Table S1, the hydraulic conductivity values in the macro areas differ chiefly for the Materials 1 and 2, which are also the most abundant in the study area. The coefficient of variation (CV), defined as the ratio of the standard deviation to the mean for each estimated parameters, is indicative of the sensitivity of the model to the parameters and low values are indicative of highly sensitive parameters. In general, the materials belonging to the coarse macro area (Zone C) are characterized by lower CVs. The lateral inflows and outflows, reported in Table S2, show a significant contribution from the lateral aquifers into the Adige Valley aquifer. The most relevant contribution comes from the Fersina alluvial fan, while the Trento slope is the smallest. Values of CV ranges from 0.28 (Fersina alluvial fan) to 3.99 (upward aquifer). The positions of these portions of the domain boundaries are shown in Figure 1B.

Streambed conductance varies along the Adige River (Table S3) with lower values inferred at the following two reaches: 3 to 13 km and 26 to 30 km. This abrupt decrease in the river conductance values occurs in correspondence with reclaimed and almost impervious areas. Hence, we attribute the lower leakage coefficients to the impervious river banks along these two portions of the river. Notice that, impervious river banks are present also along the Noce River, in the area in which it crosses the Nave San Rocco Ditches, and also in these areas the river conductance is particularly small.

Table S1. Statistics of the estimated values of hydraulic conductivity for the four different materials in the three different zones.

HydCond (m/d)	Range of Variability in the PSO		Mean of the Estimated Values	Coefficient of Variation
	Lower Bound	Upper Bound		
MATERIAL 1 ZONE C	200	3000	1886.42	0.42
MATERIAL 2 ZONE C	100	1000	948.71	0.08
MATERIAL 3 ZONE C	10	200	186.77	0.11
MATERIAL 4 ZONE C	0.1	10	8.77	0.2
MATERIAL 1 ZONE M	200	3000	2016.34	0.52
MATERIAL 2 ZONE M	100	1000	602.19	0.65
MATERIAL 3 ZONE M	10	200	145.46	0.44
MATERIAL 4 ZONE M	0.1	10	8.29	0.3
MATERIAL 1 ZONE F	200	3000	1328.07	0.89
MATERIAL 2 ZONE F	100	1000	521.14	0.71
MATERIAL 3 ZONE F	10	200	143.52	0.46
MATERIAL 4 ZONE F	0.1	10	7.73	0.39

Table S2. Statistics of the estimated values of lateral inflows and outflows. The position and extension of these boundaries are depicted in the Figure 1B.

Lateral Inflows and Outflows (m ³ /d)	Range of Variability in the PSO		Mean of the Estimated Values	Coefficient of Variation
	Lower Bound	Upper Bound		
Lavis Alluvial Fan	50,000	150,000	75,309.96	0.34
Downward aquifer	−100,000.0	−10,000	−37,310.78	0.71
Fersina Alluvial Fan	10,000.0	100,000	80,518.20	0.28
Mezzocorona Slope	10,000.0	100,000	63,001.67	0.58
Gardolo Slope	10,000.0	100,000	67,200.55	0.43
Noce Alluvial Fan	10,000.0	100,000	59,720.48	0.53
Mezzolombardo Slope	1,000.0	100,000	39,372.27	0.67
San Michele Slope	10,000.0	100,000	77,473.99	0.36
Spini Slope	1000.0	80,000	33,439.07	0.96
Trento Slope	0.0	50,000	2,045.26	3.99
Upward Aquifer	1000	50,000	5,949.24	1.01

Table S3. Statistics of the estimated values of river conductance.

River Conductance (m ² /d)	Range of Variability in the PSO		Mean of the Estimated Values	Coefficient of Variation
	Lower Bound	Upper Bound		
Adige R. 0–3 km	1.0	500	475.03	0.06
Adige R. 3–13 km	0.01	500	27.2	3.71
Adige R. 13–26 km	1.0	500	439.27	0.16
Adige R. 26–30 km	1.0	500	218.27	1.05
Noce R.	0.008	10	2.75	1.28
Avisio R.	0.01	100	57.27	0.58
Fersina R.	1.0	500	109.01	1.21
Ditches	1.0	100	56.63	0.49